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***Frontier Hard Chrome  
Event 6 Long-Term Monitoring Report  
(March 2006 Results)***

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***Department of Ecology Contract: C0500198***

***April 2006***



***Weston Solutions, Inc. • 190 Queen Anne Avenue North • Seattle, WA 98109-4926***

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LONG-TERM MONITORING REPORT  
EVENT 6—MARCH 2006  
VANCOUVER, WASHINGTON**

*Prepared for*

**Washington State Department of Ecology  
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Olympia, Washington 98504**

Contract No. C0500198

Weston Work Order No. 10799.004.001.0020

April 2006

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## **SECTION 1**

### **INTRODUCTION AND BACKGROUND**

#### **1.1 INTRODUCTION**

This Long Term Monitoring Report has been prepared under Contract C0500198 to the State of Washington Department of Ecology (Ecology) for Long Term Monitoring of the Frontier Hard Chrome (FHC) site located in Vancouver Washington.

This report describes the sampling activities performed and analytical results obtained during “Event 6” of the long-term groundwater monitoring program at FHC. Sampling activities for Event 6 were conducted during March 2006.

The FHC site was the subject of a remedial action conducted during the summer of 2003. The purpose of the remedial action (RA) was to treat the site’s chromium-contaminated soil and groundwater to cleanup levels specified in the Record of Decision. Long term monitoring is required to track offsite plume concentrations as well as show that the remedy is maintaining its operational functionality.

The first 3 groundwater monitoring events (Events 1 through 3) were conducted for the United States Environmental Protection Agency (EPA). In October 2004, responsibility for this site was turned over to Ecology. Ecology contracted Weston Solutions, Inc. (Weston) to perform the next 2 rounds of monitoring (Events 4 and 5) as a result of Weston’s familiarity with this site and the associated property owners. Ecology amended Weston’s contract in February 2006 to perform 6 additional rounds of quarterly monitoring with the last to be completed in June 2007.

All Event 6 work was performed in accordance with project work plan titled *Frontier Hard Chrome, Long Term Monitoring Plan* (Weston 2004). One significant deviation from the work plan occurred. Wells W85-6A and W85-6B could not be sampled because they had been destroyed during construction of a shopping mall in the area where the wells were located.

#### **1.2 BACKGROUND AND PROBLEM DEFINITION**

##### **1.2.1 Site Background**

The FHC site is located in southeastern Vancouver, Washington (Figure 1). The facility address is 113 “Y” Street, Vancouver, Washington. The site is located in the Section 25, Township 2 north, Range 1 east, Willamette Meridian in Clark County, Washington. The location in latitude and longitude coordinates is 45 degrees, 37 minutes, 19 seconds north by 122 degrees, 38 minutes 45 seconds east (Degrees, Minutes, Seconds [DMS]). The site was previously occupied by several metals fabricating businesses and was used for storage and as a staging area for a neighboring business. Currently, no buildings exist on the site and the site is vacant. A truck driving school is operating on the parcel south of the site.

The FHC site proper covers approximately 0.5 acre and is bordered to the east by Grand Avenue, to the south by Test-U, and to the west by “Y” Street.

Work began on the remedial design in October 2001. The remedial design was completed in February 2003. The remedial action, consisting of building demolition, treatment of source area soil and groundwater, and installation of an in-situ redox manipulation (ISRM) treatment wall (to treat hexavalent chromium), was completed in September 2003.

### **1.2.2 Problem Definition**

The goal of the remedial action was to treat source area soil and groundwater to reduce hexavalent chromium concentrations such that groundwater downgradient of the site would attenuate to chromium concentrations less than 50 micrograms per liter (ug/L). To demonstrate this, groundwater quality was monitored in two areas. The first area consisted of locations immediately within and down gradient of the ISRM wall. Wells located within and just down gradient of the wall were monitored to ensure the continued operational functionality of the ISRM Treatment Wall. The second area monitored consisted of the historical chromium contaminated groundwater plume located down gradient of the ISRM wall. This down gradient plume did not receive treatment during the remedial action and was monitored to track the long-term expected reduction in chromium concentration as a result of completing the remedial action and elimination of the source of hexavalent chromium.

Long-term groundwater monitoring is required by the site’s Record of Decision.

## **1.3 MONITORING SCHEDULE**

Sampling events performed for EPA were conducted approximately quarterly for the first year after completion of the remedial action. Planned sampling events were completed in February, April, and August 2004. The sampling event performed the week of 16 August 2004 concluded monitoring for approximately one year after the remedial action was completed.

In September/October 2004, monitoring of the FHC site was turned over to the Washington State Department of Ecology. Sampling of the site groundwater for Ecology occurred in May 2005 and again in December 2005. In February 2006, Ecology amended Weston’s contract to perform 6 additional rounds of monitoring to be done quarterly: March 2006, June 2006, September 2006, December 2006, March 2007 and June 2007.

## SECTION 2

### SAMPLING ACTIVITIES AND RESULTS

#### 2.1 MONITORING WELL SAMPLING PROCEDURES

Sampling activities for Event 6 were conducted on March 6 through March 9, 2006 by Weston Solutions, Inc, (Weston).

The monitoring wells in the vicinity of the FHC site are shown on Figure 2. A total of 31 wells (instead of the typical 33 wells) in the vicinity of the site were sampled for metals in accordance with the *Long Term Monitoring Plan* (Weston 2004). Wells W85-6A and W85-6B had been destroyed sometime before December 2005 by construction and could not be sampled.

Well purging and sampling were performed according to sampling guidelines and Weston standard operating procedures. The wells were sampled with a peristaltic pump equipped with new polyethylene tubing deployed to mid-screen depth at each well. The wells were purged prior to sampling until monitored field parameters (turbidity, conductivity, pH, dissolved oxygen, ORP, and temperature) stabilized. The field parameter readings were recorded on field sampling forms.

Groundwater samples were analyzed for total analytes list (TAL) metals. In cases where groundwater turbidity was greater than 10 nephelometric turbidity units, samples were passed through a 0.45-micron filter in the field and submitted for dissolved TAL metals. Only one well (RA-MW-12A) had turbidity in excess of 10 NTU. During Event 6, both total and dissolved metals analyses were performed on samples collected from RA-MW-15B and RA-MW-16B at Ecology's request. In addition, filtered samples were also collected from wells RA-MW-11B and RA-MW-16A (even though turbidity did not exceed 10 NTU) to remove tiny bits of black particles that could be observed suspended in the sample.

Selected samples were analyzed for total sulfur and sulfate to provide an assessment of the distribution of byproducts from the reducing agent used during ISRM wall installation.

Groundwater chromium concentrations are provided in Table 1. Measured field parameters are provided in Table 2.

#### 2.2 ANALYTICAL RESULTS

##### 2.2.1 Chromium

Chromium was detected in 26 of the 31 wells sampled. Total chromium concentrations in the "A" zone ranged from a maximum concentration of 84.5 ug/L in well RA-MW-12A to non-detectable concentrations at well W92-16A. All wells except RA-MW-12A and B87-8 had total chromium concentrations less than 10 ug/L. Monitoring well RA-MW-12A (which has



generally had the highest concentration of chromium) had a dissolved concentration of 9.6 ug/L (down from the 10.2 ug/L in December 2005). Filtered samples (in addition to unfiltered samples) have been routinely collected from well RA-MW-12A due to its high turbidity. Overall, chromium in filtered samples from well RA-MW-12A have decreased from 192 ug/L (October 2003) to the current concentration of 9.6 ug/L. “A” zone chromium concentrations and plume contours are shown in Figure 3. Filtered sample data was used in preparing Figure 3 where available.

Chromium concentrations in “B” zone groundwater were similar to those in “A” zone groundwater. Total chromium concentrations in “B” zone groundwater ranged from a maximum of 192 ug/L downgradient of the site (well RA-MW-15B) to non-detectable concentrations in 4 locations. The filtered sample from well RA-MW-15B had a chromium concentration of 8.7 ug/L. “B” zone chromium concentrations and plume contours are shown in Figure 4. Filtered sample data was used in preparing Figure 4 where available.

Figures showing the chromium concentration trends in groundwater over time are included in Appendix A. Data from wells sampled during Operational and Functional monitoring in November and December 2003 are included in these figures where available to assist in determining trends. Laboratory chromium data sheets for the March 2006 sampling event are provided in Appendix B.

Figures 3, 4, and those in Appendix A used filtered chromium values where available. In this latest March 2006 round of sampling, turbidity exceeded 10 NTU in only a single well; RA-MW-12A. However, filtered samples were also collected from well RA-MW-11B, RA-MW-16A, RA-MW-15B, and RA-MW-16B. Filtered samples were collected from well RA-MW-11B and RA-MW-16A even though turbidity did not exceed 10 NTU due to the presence of very small black particles in the sample. Filtered samples were also collected from wells RA-MW-15B and RA-MW-16B at the request of Ecology to assist in determining the cause of the elevated chromium concentrations during the December 2005 sampling event.

### **2.2.2 Water Quality**

Dissolved oxygen (DO) concentrations ranged from a low of 0 mg/L to a high of 10.3 mg/L. DO averaged 1.58 mg/L in samples collected within the ISRM Treatment Wall. The concentration of DO in this latest round of sampling is greater than the previous round of sampling. Even though the current concentrations of DO have increased, the relatively low DO concentrations indicates the wall is still reductive which is necessary for treatment of hexavalent chromium. Samples of groundwater collected downgradient of the ISRM Treatment Wall had the highest concentrations of DO which tended to increase with distance from the wall.

pH ranged from 6.1 to 8.2. The highest pH was located within the treatment zone; this trend is consistent with the high pH of the reagent used to create the ISRM Treatment Wall.

The highest sulfur and sulfate concentrations were located within the treatment wall. Maximum sulfur and sulfate concentrations in groundwater were 448 mg/L and 3040 mg/L, respectively.

Concentrations of sulfur and sulfate were significantly lower immediately downgradient of the wall.

### **2.3 GROUNDWATER FLOW DIRECTION AND ELEVATION**

Groundwater surface elevations were determined using the known elevation of the top of each well casing and the depth to groundwater measured in each long term monitoring well. The depth to groundwater measurements were collected during the morning of 9 March 2006. The Columbia River elevation at the United State Geological Survey (USGS) gauging station 14144700 located at the nearby I-5 bridge was obtained for use in determining flow direction. The elevation of the river at 0900 hours on 09 March 2006 was 6.90 feet (corrected to NGVD 1929 by adding 1.82 feet to the measured river elevation). The river elevation information can be obtained from <http://waterdata.usgs.gov/wa/nwis/>.

Groundwater surface elevations for each well measured are shown in Table 4.

The groundwater flow direction (as determined using groundwater surface elevations measured in each well within a period of 1.5 hours) is heading away from the FHC site. A horizontal gradient was calculated for 09 March 2006 with a result of 0.00015 ft/ft with a flow direction from the FHC site towards the Columbia River. The groundwater table during this period had a drop in elevation of 0.35 feet over a distance of 2,400 feet.

Groundwater elevation and gradient information is graphically shown in Figure 5.

### **2.4 QUALITY ASSURANCE**

Data quality was checked by running field duplicates, laboratory duplicates and matrix spikes. Table 5 shows the results from laboratory quality control efforts.

Duplicates were run on both filtered and unfiltered samples during this sampling event. Filtered duplicate results had good correlation to the original sample results. The duplicate run on the unfiltered sample had greater deviation. The difference in the duplicate unfiltered sample was attributed to particulate in the sample.

### **2.5 INVESTIGATION-DERIVED WASTES**

Investigation-derived waste (IDW) generated during the sampling event consisted of well purge water, used PPE, and disposable sampling supplies. During sampling, purge water was stored on site in 5-gallon buckets. At the completion of sampling, the water was transported to the City of Vancouver's operations center and disposed of in accordance with the disposal permit issued to Weston by the city. Approximately 74 gallons of water was disposed. Personnel protective equipment and other solid wastes were disposed of in a dumpster.

## 2.6 DISCUSSION AND CONCLUSIONS

Chromium concentrations in onsite “A” zone groundwater in and around the ISRM Treatment Wall were less than 10 ug/L. Chromium concentrations in groundwater between the ISRM Treatment Wall and East 1<sup>st</sup> Street were also less than 10 ug/L. Chromium concentrations in well B87-8, located south of East 1<sup>st</sup> Street, were 50 ug/L. In general, the chromium concentrations in groundwater on and downgradient of the site were relatively uniform during the March 2006 sampling event with almost all chromium concentration less than 10 ug/L.

The deeper “B” zone groundwater downgradient of the site contained chromium in concentrations similar to that in the “A” zone. Chromium concentrations in “B” zone groundwater on and downgradient of the site were also less than 10 ug/L (with the exception of well RA-MW-15B which had a total chromium concentration of 192 ug/L).

Wells RA-MW-15B and RA-MW-16B have had anomalously elevated chromium concentrations in unfiltered samples in the last few rounds of sampling beginning in May 2005. Small black particulate was also observed in samples collected from these wells in December 2005. Therefore, both unfiltered and filtered samples were collected from these wells during this sampling event regardless of turbidity. The unfiltered sample from well RA-MW-15B had a chromium concentration of 192 ug/L whereas the filtered sample had a chromium concentration of 8.7 ug/L. Groundwater from well RA-MW-15B also had an initial yellow-green color as it was pumped from the well indicating treatment reagent had migrated to this well. After pumping, the water turned clear. The unfiltered and filtered sample from well RA-MW-16B had minimal differences in chromium concentrations (unfiltered – 3.7 ug/L; filtered – 7.0 ug/L).

Similar to the December 2005 groundwater sampling event, turbidity in several of the samples was difficult to control. Any slight movement of the tubing inside the well casing caused the turbidity to spike and release black particulate into the water. Care was taken to let the turbidity subside before samples were collected.

Wells RA-MW-15B and RA-MW-16A located downgradient of the treatment wall had evidence that reagents had reached these wells. Well RA-MW-16A generated purge water that had a strong sulfur smell and was initially black (due to black particulate which settled out) when purged. It's likely that the black settleable particulate is due to insoluble metal sulfides, including chromium sulfide. These black particulates are expected and indicate the treatment has turned soluble metals into insoluble particulate as planned. Well RA-MW-15B purge water was a yellow green (which was the color of the treatment reagent). Up to this point, no signs of reagent were seen in these wells during previous sampling events.

Dissolved oxygen data collected from within the ISRM Treatment Wall indicates that an area of reducing conditions still exists implying the hexavalent chromium treatment zone is still active. Most locations within the treatment wall contain dissolved oxygen at concentrations less than 2.0 mg/L and negative oxygen reduction potential (ORP) implying reducing conditions are present.

Sulfur/sulfate concentrations within the ISRM Treatment Wall have fluctuated while sulfur/sulfate concentrations downgradient of the ISRM Treatment Wall have generally

increased since February 2004. Sulfur/sulfate concentrations in well B87-8 and B85-4 located across East 1<sup>st</sup> Street (downgradient of the site) have increased by a factor of approximately 5 to 6 since February 2004. Sulfur and sulfate concentrations were less than 160 mg/L and 430 mg/L in most locations sampled during March.

Overall, the chromium concentrations during this round of sampling are similar to previous rounds. Dissolved oxygen in samples from wells located within the treatment wall was higher than usual. In addition, there was evidence that the sulfur bearing reagents had reached downgradient wells RA-MW-16A and RA-MW-15B whereas this had not been apparent in previous rounds of sampling. It is believed these observations occurred as a result of the intense rains that occurred in January 2006. The additional infiltration likely flushed reagents downgradient of the treatment zone and increased the dissolved oxygen in the groundwater.

## SECTION 3

### ANALYTICAL METHODS AND DATA VALIDATION

#### 3.1 ANALYTICAL METHODS REQUIREMENTS AND DATA VALIDATION

The laboratory data quality assurance review and validation of analytical results for 33 water samples has been completed. Samples were collected between 06 March 2006 and 08 March 2006 from the Frontier Hard Chrome site and were analyzed for dissolved and total recoverable chromium

The quality assurance review was performed on the laboratory data sheets and the WDOE memorandum to ensure that the analytical results met data quality objectives for the project. All laboratory quality assurance results as applicable (e.g., holding times, blank sample analysis, matrix spike/duplicate analysis, laboratory control sample analysis) supplied to Weston for the analyses met acceptance criteria specified in the work plan (Weston 2004).

Samples **RA-MW-12A** and **RA-MW-15B** were collected both as total (unfiltered) and dissolved (field-filtered) fractions – with one fraction submitted for total recoverable chromium analysis and the other filtered at the time of collection and submitted for dissolved chromium analysis.

Determination of duplicate precision, reported as relative percent difference (RPD), yielded acceptable results. As expected – and likely due to the presence of suspended, black particulate matter assumed to be metal sulfides – the RPD for the unfiltered sample aliquots (23.2%) slightly exceeded the commonly-accepted value of 20-percent for aqueous samples. This exceedance did not adversely affect the project DQOs.

Data validation documentation is provided in Appendix C.

## **SECTION 4**

### **REFERENCES**

EPA (United States Environmental Protection Agency), 2003. Statement of Work for Long Term Response Action. Frontier Hard Chrome, Vancouver, WA. December 30<sup>th</sup>, 2003.

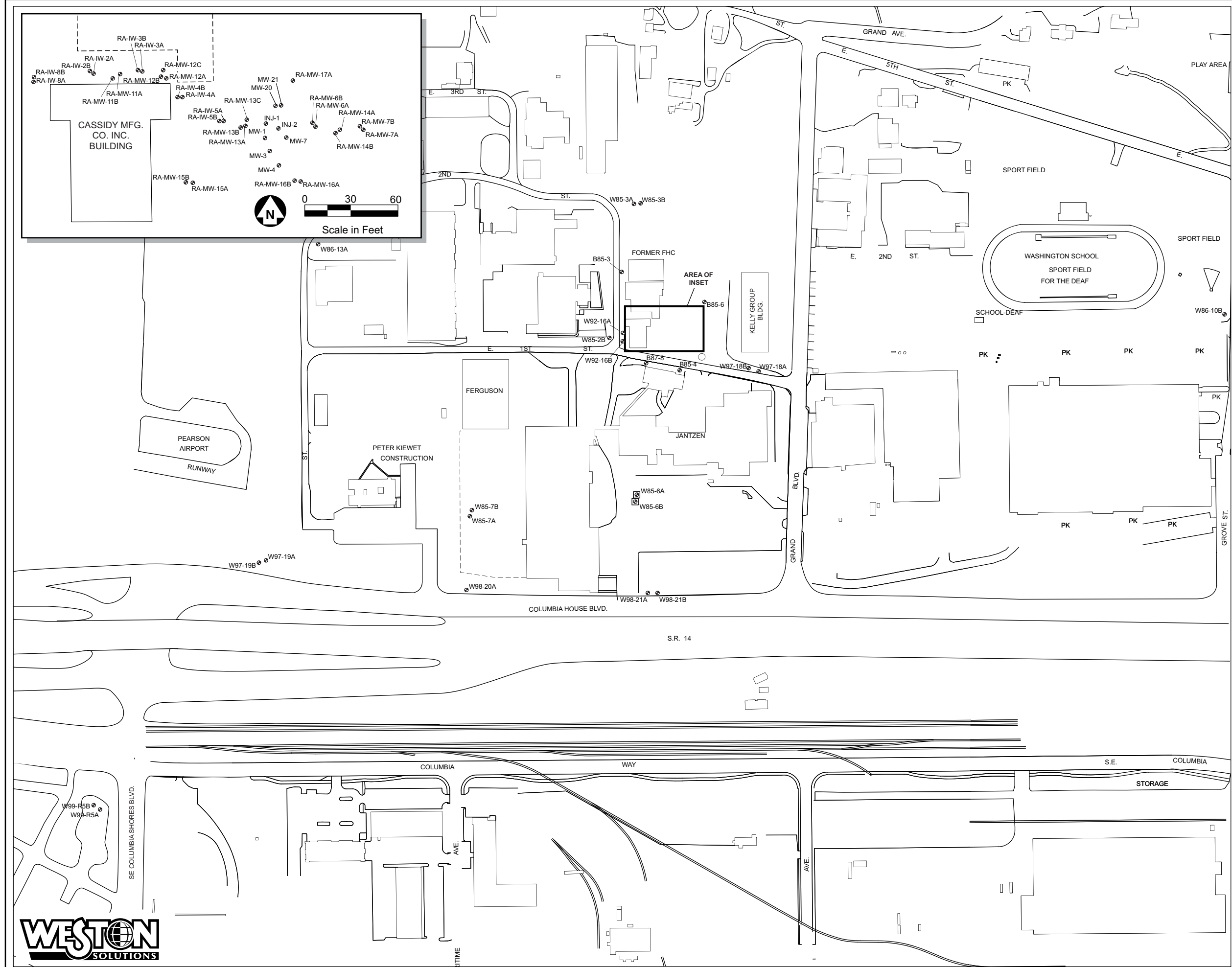
Weston (Weston Solutions, Inc.), 2004. Frontier Hard Chrome Long Term Monitoring Plan. Prepared for the U.S. Environmental Protection Agency, Region 10, Seattle, Washington. February.

## FIGURES












**LEGEND**

W85-5B  Monitoring Well Location and ID

W85-6B  Well Missing Due to Construction

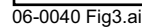
--- Fence

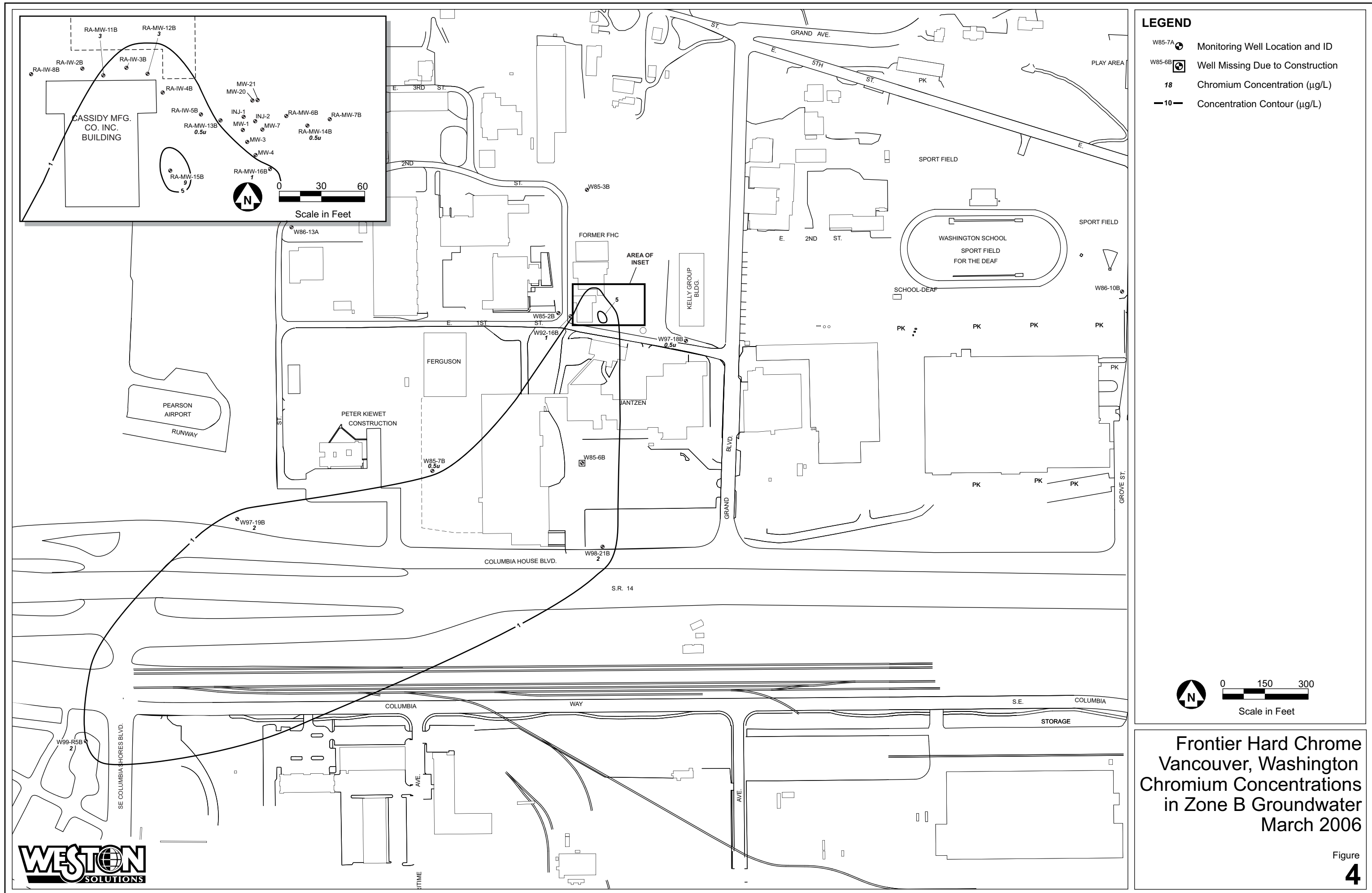
 0 150 300  
Scale in Feet

Frontier Hard Chrome  
Vancouver, Washington  
Monitoring Well Locations

Figure  
**2**

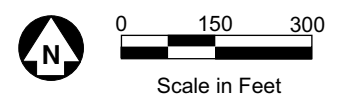








- LEGEND**
- W85-7A ● Monitoring Well Location and ID
  - W85-6B ◻ Well Missing Due to Construction
  - 6.32 Groundwater Elevation (ft. AMSL)
  - 6.40 — Groundwater Elevation Contour
  - Fence



Frontier Hard Chrome  
Vancouver, Washington  
A Zone  
Groundwater Elevations  
March 9, 2006

Figure  
**5**



## **TABLES**

**Table 1—Frontier Hard Chrome—Event 6 Chromium Results**

Well Number	Concentration (ug/L)		Sample Observations
	Total	Dissolved	
RA-MW-12A	84.5	9.6	Yellow-green color, sulfur smell.
RA-MW-12B	3.3	--	Yellow-green color, sulfur smell.
RA-MW-12C	2.2	--	
RA-MW-11A	5.2	--	
RA-MW-11B	3.6	3.3	Black, sulfur smell.
RA-MW-13A	1.9	--	
RA-MW-13B	0.5U	--	
RA-MW-13C	1.4	--	
RA-MW-17A	8.6	--	
RA-MW-14A	1.8	--	
RA-MW-14B	0.5U	--	Green.
RA-MW-16A	3.7	7.0	Initially clear; turned black, sulfur smell.
RA-MW-16B	1.3	3.4	
RA-MW-15A	5.3	--	
RA-MW-15B	192	8.7	Yellow-green, no odor.
B87-8	50.4	--	
B85-3	4.9	--	
W92-16A	0.5U	--	
W92-16B	1.0	--	
B85-4	5.8	--	
W97-18A	0.53	--	
W97-18B	0.5U	--	
W85-7A	1.7	--	
W85-7B	0.5U	--	
W97-19A	1.2	--	
W97-19B	1.8	--	
W98-20A	1.5	--	
W99-R5A	0.66	--	
W99-R5B	1.8	--	
W98-21A	1.9	--	
W98-21B	2.2	--	
W85-6A	--	--	
W85-6B	--	--	

-- denotes no sample collected

U: denotes analyte was not detected

**Table 2—Frontier Hard Chrome—Event 6 Monitoring Field Parameters<sup>1</sup>**

Well Number	Temp C	Spec. Cond. (mS/cm)	DO (mg/L)	pH	ORP (mV)	Sulfur <sup>2</sup> (mg/L)	Sulfate <sup>2</sup> (mg/L)	Turbidity (NTU)
RA-MW-12A	14.6	2.47	0	8.19	-393			60
RA-MW-12B	14.9	1.34	1.26	8.16	-345			1.7
RA-MW-12C	14.3	0.69	1.1	7.89	-234			1
RA-MW-11A	15.1	2.01	0	6.64	-246	448	3040	1
RA-MW-11B	14.7	1.17	0.19	7	-301			5
RA-MW-13A	14.3	2.17	0.38	6.82	-176	310	1980	4
RA-MW-13B	14.3	0.81	0.45	7.15	-197			0
RA-MW-13C	13.8	0.79	0.96	7.25	-175			6
RA-MW-17A	13.7	1.3	3.69	6.5	-89			7
RA-MW-14A	10.8	0.87	6.74	6.6	-136	158	429	1
RA-MW-14B	12.3	0.78	2.58	6.87	-133			4
RA-MW-16A	13.3	1.04	5.4	6.62	-160			1.7
RA-MW-16B	13.7	0.67	1.85	7.06	-131			0
RA-MW-15A	14.8	1.53	8.34	6.47	-137			0
RA-MW-15B	14.0	0.92	0.79	6.51	16			5
B87-8	14.4	0.38	0.53	6.57	73	48	125	8
B85-3	14.1	0.74	2.97	6.64	-62			7
W92-16A	13.8	0.28	0.15	6.6	-32			0.7
W92-16B	13.7	0.34	1.02	7.54	-103			8.7
B85-4	13.5	0.74	0.22	6.49	75	103	253	3.9
W97-18A	12.0	0.19	4	6.57	137			0
W97-18B	10.7	0.19	1.17	6.16	152			1.4
W85-7A	12.3	0.1	6.7	6.35	113	3	8	0
W85-7B	12.8	0.01	10.3	6.14	146			0
W97-19A	12.9	0.19	3.51	6.41	149			1
W97-19B	12.4	0.19	2.99	6.68	142			5
W98-20A	13.1	0.13	5.1	6.18	171			0
W99-R5A	14.7	0.2	1.83	6.28	197	7	15	0
W99-R5B	13.9	0.22	2.03	6.55	204			0
W98-21A	13.8	0.19	1.05	6.25	160	10	25	0
W98-21B	13.0	0.22	1.08	6.36	161			0
W85-6A	NS	NS	NS	NS	NS			NS
W85-6B	NS	NS	NS	NS	NS			NS

Notes:

<sup>1</sup>Parameters measured after readings stabilized.

<sup>2</sup>Sulfur and sulfate data obtained from laboratory analyses.

NS: No sample collected; well destroyed.

Table 3—Comparison of Conventional Parameters

Well #	Temp (C)						Conductivity (mS/cm)						DO (mg/L)					
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06
RA-MW-12A	14.9	15.9	17.9	15.2	14.9	14.6	6.01	5.4	4	3.32	2.52	2.47	0.24	0.09	0.2	0.13	0.04	0
RA-MW-12B	14.4	16.6	16.7	15.6	14.3	14.9	2.25	1.19	1.52	2.56	2.47	1.34	0.27	0.07	0.27	0.07	0.05	1.26
RA-MW-12C	14.4	16.5	16.6	15.1	14.2	14.3	2.18	1.34	1.13	0.68	1.09	0.69	0.2	0.14	0.42	0.25	0.07	1.1
RA-MW-11A	15.7	16.5	17.4	15.7	15.0	15.1	1.67	1.89	2.02	1.48	1.82	2.01	0.32	0.10	0.66	6.69	0.16	0
RA-MW-11B	14.9	16.3	17	15.6	14.9	14.7	1.49	2.08	2.02	1.72	2.25	1.17	0.19	0.15	0.5	0.14	0.1	0.19
RA-MW-13A	15	14.6	15.73	14.9	14.5	14.3	5.21	2.42	3.29	2.83	2.49	2.17	1.63	0.17	1.13	0.53	0.11	0.38
RA-MW-13B	14.8	14.7	15.4	14.9	14.2	14.3	3.73	1.38	2.15	2.41	2.16	0.81	0.73	0.16	0.73	0.51	0.21	0.45
RA-MW-13C	14.2	15	14.9	14.5	14.3	13.8	3.07	1.82	1.41	1.28	0.71	0.79	0.22	0.15	0.43	1.4	2.98	0.96
RA-MW-17A	14.3	15.3	16.7	15.1	14.5	13.7	1.8	1.8	1.8	1.39	1.18	1.3	0.6	0.19	1.99	0.6	0.2	3.69
RA-MW-14A	13.9	14.3	15.3	14.6	14.7	10.8	1.43	1.71	1.96	1.08	0.88	0.87	0.89	0.22	5.96	0.51	0.22	6.74
RA-MW-14B	14	14.9	15.5	14.5	14.1	12.3	1.56	1.21	0.98	1.08	1	0.78	1.08	0.10	2.77	0.42	0.12	2.58
RA-MW-16A	14.3	14.9	16	14.9	15.1	13.3	2.95	1.46	2	1.7	1.07	1.04	0.73	0.27	1.39	1.6	0.11	5.4
RA-MW-16B	14.3	14.6	16	14.7	13.9	13.7	2.42	1.19	1.4	1.81	0.92	0.67	0.75	0.15	0.86	0.75	0.33	1.85
RA-MW-15A	14.3	14.5	15	15	14.7	14.8	1.88	1.04	1.08	1.3	1.42	1.53	0.33	0.21	1.53	0.47	0.15	8.34
RA-MW-15B	13.9	14.4	15.4	14.7	14.1	14.0	0.47	0.86	0.68	0.64	0.91	0.92	0.22	0.10	0.74	0.44	0.18	0.79
B87-8	14.5	14.7	15.8	15.2	14.7	14.4	0.26	0.55	0.36	0.29	0.24	0.38	0.13	1.03	1.06	0.35	0.28	0.53
B85-3	14.6	14.8	15.2	15.8	14.4	14.1	0.99	0.90	0.98	0.81	0.54	0.74	1.11	0.16	1.57	4.5	0.12	2.97
W92-16A	14.2	15.6	16.1	15.3	14.0	13.8	0.33	0.25	0.27	0.23	0.24	0.28	0.98	0.13	2.49	3.1	0.28	0.15
W92-16B	14.1	14.7	16.2	15.2	13.7	13.7	1.17	1.37	0.95	0.66	0.09	0.34	0.14	0.53	1.97	3.4	5.4	1.02
B85-4	14.1	14.4	15.1	14.4	13.9	13.5	0.41	1.17	0.51	0.71	0.28	0.74	0.65	1.37	1.5	0.33	0.2	0.22
W97-18A	11.3	11.0	15.0	12.7	13.9	12.0	0.11	0.09	0.11	0.08	0.1	0.19	1.27	0.74	1.09	0.5	1.1	4
W97-18B	11.4	12.4	14.4	13.5	13.0	10.7	0.26	0.24	0.27	0.22	0.19	0.19	2.01	5.56	4.52	4.9	2	1.17
W85-7A	11.4	12.6	14.9	13.9	14.5	12.3	0.13	0.14	0.21	0.12	0.11	0.1	4.05	3.17	2.18	4.3	2.2	6.7
W85-7B	12.1	13.0	14.5	13.6	14.1	12.8	0.28	0.31	0.32	0.01	0.01	0.01	2.78	5.11	6.1	8.7	4	10.3
W97-19A	12.5	13.3	16	14.3	13.8	12.9	0.25	0.26	0.28	0.23	0.23	0.19	4.72	1.79	22.73	4.6	0.97	3.51
W97-19B	12.7	13.3	15.9	15.3	13.3	12.4	0.26	0.26	0.29	0.22	0.06	0.19	1.81	1.31	2.6	2.6	1.1	2.99
W98-20A	13.8	12.5	15.4	14.3	14.3	13.1	0.16	0.15	0.23	0.12	0.12	0.13	4.92	3.76	5.5	5	3.2	5.1
W99-R5A	14.2	14.9	15.7	14.8	14.8	14.7	0.24	0.25	0.24	0.22	0.21	0.2	4.72	4.26	5.6	5.3	3.3	1.83
W99-R5B	13.9	14.4	15.6	14.4	14.5	13.9	0.26	0.26	0.27	0.23	0.22	0.22	3.97	2.71	4.7	5.1	1.9	2.03
W98-21A	13.1	14.3	14.2	13.8	13.9	13.8	0.16	0.23	0.29	0.45	0.19	0.19	1.29	1.49	3.03	13.3	1.2	1.05
W98-21B	13.1	13.6	14	13.8	13.7	13.0	0.24	0.27	0.27	0.25	0.18	0.22	1.24	3.29	2.82	17.7	3.9	1.08
W85-6A	14.1	14.1	15.5	14			0.11	0.33	0.34	299			4.92	0.43	0.85	4.9		
W85-6B	13.6	13.8	16.3	13.7			0.31	0.41	0.33	0.26			3.46	6.13	6.54	5.5		



Table 3—Comparison of Conventional Parameters (continued)

Well #	pH						ORP (mV)					
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06
RA-MW-12A	8.86	8.73	8.86	8.98	8.41	8.19	-468	-466	-430	-417	-403	-393
RA-MW-12B	7.77	7.83	7.92	8.3	8.68	8.16	-363	-321	-315	-415	-414	-345
RA-MW-12C	8.13	7.92	8.09	7.95	8.14	7.89	-282	-179	-154	-239	-314	-234
RA-MW-11A	7.51	7.53	7	6.52	6.64	6.64	-384	-391	-316	-110	-241	-246
RA-MW-11B	7.66	7.9	7.2	6.7	6.73	7	-394	-393	-332	-296	-289	-301
RA-MW-13A	7.15	7.15	7.03	6.7	6.86	6.82	-155	-102	-97	-94	-204	-176
RA-MW-13B	7.23	7.56	7.3	6.86	6.99	7.15	-129	-123	-104	-105	-125	-197
RA-MW-13C	7.36	7.35	7.44	7.33	7.48	7.25	-136	-126	-116	-142	-33	-175
RA-MW-17A	6.55	6.43	6.61	6.2	6.39	6.5	-91	-40	-7	-5	-27	-89
RA-MW-14A	6.64	6.81	6.99	6.5	6.6	6.6	-77	-41	-54	-75	-82	-136
RA-MW-14B	6.9	7.14	7.33	6.75	6.78	6.87	-112	-95	-102	-112	-134	-133
RA-MW-16A	6.61	6.61	6.75	6.42	6.44	6.62	-94	-45	-58	-156	-103	-160
RA-MW-16B	6.42	7.12	7.09	6.31	7.12	7.06	-57	-70	-60	-85	-130	-131
RA-MW-15A	6.35	6.37	6.74	6.2	6.3	6.47	-47	4	39	10	-12	-137
RA-MW-15B	6.35	6.83	7.18	6.39	6.39	6.51	-5	28	15	17	-11	16
B87-8	6.55	6.31	6.73	6.54	6.68	6.57	-8	31	17	199	2	73
B85-3	6.49	6.68	6.91	6.39	6.7	6.64	-7.3	-107	-37	-47	-93	-62
W92-16A	6.42	6.42	6.72	6.6	6.56	6.6	1	-14	30	110	110	-32
W92-16B	7.51	7.58	7.63	7.59	6.88	7.54	-116	-61	-60	73	119	-103
B85-4	6.14	6.26	6.53	6.22	6.51	6.49	10	41	59	218	-26	75
W97-18A	5.83	5.96	6.19	6.17	6.78	6.57	32	57	67	103	58	137
W97-18B	6.57	6.35	6.67	6.41	6.6	6.16	57	63	60	188	83	152
W85-7A	6.24	6.04	6.26	6.2	6.3	6.35	68	83	57	197	116	113
W85-7B	6.63	6.51	6.71	5.91	6.18	6.14	59	73	66	215	132	146
W97-19A	6.35	6.24	6.28	6.35	6.59	6.41	71	94	72	218	69	149
W97-19B	6.68	6.49	6.3	6.47	6.68	6.68	56	86	56	52	76	142
W98-20A	6.01	5.91	6.32	5.97	6.29	6.18	52	116	84	219	116	171
W99-R5A	6.03	5.98	6.28	6.21	6.22	6.28	58	96	97	153	123	197
W99-R5B	6.2	6.23	6.55	6.33	6.63	6.55	58	78	74	201	92	204
W98-21A	5.92	6.07	6.68	6.18	6.3	6.25	28	69	79	182	113	160
W98-21B	6.04	6.07	6.9	6.24	6.64	6.36	33	72	47	202	121	161
W85-6A	6.23	6.22	6.4	6.36			17	57	86	163		
W85-6B	6.4	6.42	6.68	6.62			19	76	72	159		

Table 3—Comparison of Conventional Parameters (continued)

Well #	Sulfur (mg/L)						Sulfate (mg/L)					
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06
RA-MW-12A												
RA-MW-12B												
RA-MW-12C												
RA-MW-11A	286	296	304	285	460	448	620	751	1040	736	1200	3040
RA-MW-11B												
RA-MW-13A	743	246	324	372	363	310	1960	712	1056	985	971	1980
RA-MW-13B												
RA-MW-13C												
RA-MW-17A												
RA-MW-14A	189	228	214	136	122	158	477	635	697	357	351	429
RA-MW-14B												
RA-MW-16A												
RA-MW-16B												
RA-MW-15A												
RA-MW-15B												
B87-8	9	52	22	17	23	48	20.7	137	73	170	63	125
B85-3												
W92-16A												
W92-16B												
B85-4	23	150	31	87	20	103	58.1	410	104	222	50	253
W97-18A												
W97-18B												
W85-7A	3	4	5	4	4	3	5.5	8.6	15	13	8	8
W85-7B												
W97-19A												
W97-19B												
W98-20A												
W99-R5A	5	6	4	5	6	7	11.6	11.8	13	15	13	15
W99-R5B												
W98-21A					8	10					19	25
W98-21B												
W85-6A		15	14	18	--	--	5.1	36	44	44	--	--
W85-6B												

**Table 4—Frontier Hard Chrome—Event 6 Ground Water Elevations 9 March 2006**

<b>Well No.</b>	<b>Time</b>	<b>Casing Elevation (feet)</b>	<b>Depth to Water (feet)</b>	<b>Water level Elevation (AMSL)</b>
W85-3A	910	26.4	18.35	8.05
W85-3B	915	26.77	18.72	8.05
W97-18A	825	25.44	17.54	7.90
W97-18B	826	25.36	17.57	7.79
B85-4	829	25.38	17.55	7.83
B87-8	830	25.95	18.05	7.90
W92-16B	843	25.51	17.7	7.81
W92-16A	844	25.62	17.59	8.03
B85-3	800	24.9	area under water	not determined
W85-7A	835	22.83	15.02	7.81
W85-7B	834	23	15.22	7.78
W97-19A	758	22.451	14.7	7.75
W97-19B	759	21.721	14.02	7.70
W98-20A	805	23.571	15.77	7.80
W85-6A	1530	25.38	well destroyed	not determined
W85-6B	1527	25.24	well destroyed	not determined
W98-21B	820	25.501	17.72	7.78
W98-21A	819	25.281	17.5	7.78
W99-R5A	811	32.26	24.58	7.68
W99-R5B	810	32.33	24.51	7.82
USGS 14144700 (Stage height of the Columbia River corrected to NGVD 1929)	900			6.90

<sup>1</sup>Two different elevation datum's have been used at Frontier Hard Chrome. Weston (12/03) Long-Term Monitoring plan has applied a correction factor (+3.76 feet) using the City of Vancouver's benchmark #108 located near FHC site.

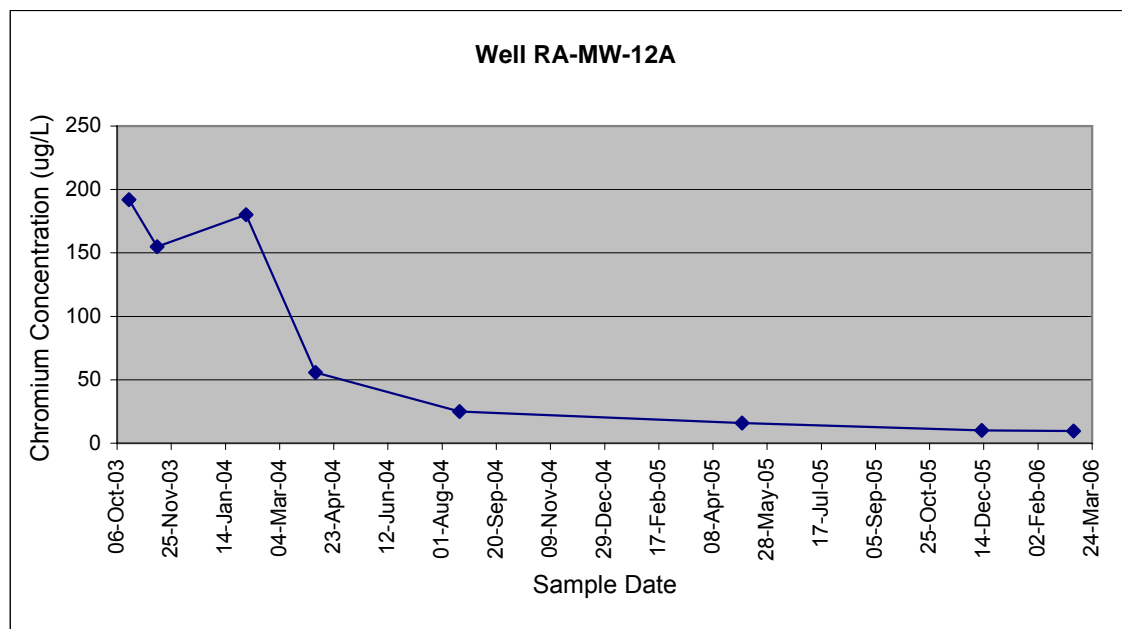
**Table 5—Quality Assurance Sample Results - Chromium**

<b>Well #</b>	<b>Sample Type</b>	<b>Original Sample Chromium Concentration (mg/L)</b>	<b>Duplicate Sample Chromium Concentration (mg/L)</b>	<b>Relative Percent Difference</b>
RA-MW-12A (filtered)	Field Duplicate	9.6	9.1	5.3%
RA-MW-15B (total)	Field Duplicate	192	152	23.2%

**APPENDIX A**  
**GROUNDWATER CHROMIUM CONCENTRATION TRENDS**

### Well RA-MW-12A

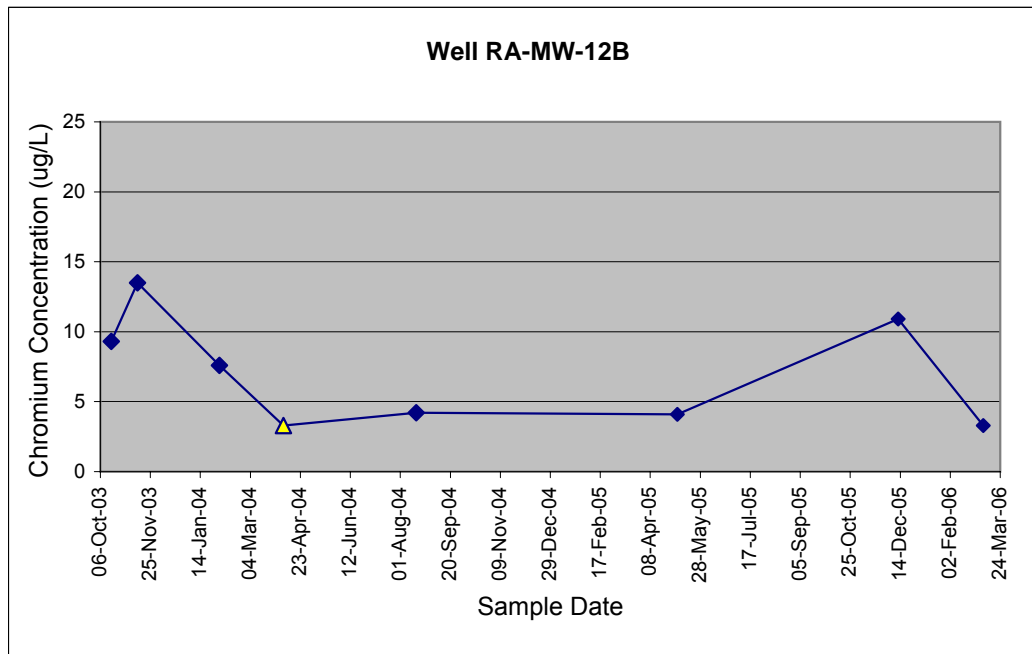
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2524	Water	17-Oct-03	CHROMIUM	192	UG/L		RA-MW-12A	Dissolved	>10
MJ27F5	Water	12-Nov-03	CHROMIUM	155	UG/L		RA-MW-12A	Dissolved	>10
MJ2AF0	Water	02-Feb-04	CHROMIUM	180	UG/L		RA-MW-12A	Total	7
MJ2BH9	Water	06-Apr-04	CHROMIUM	55.8	UG/L		RA-MW-12A	Dissolved	17
MJ4725	Water	17-Aug-04	CHROMIUM	24.9	UG/L		RA-MW-12A	Dissolved	12
184253	Water	5-May-05	CHROMIUM	16	UG/L		RA-MW-12A	Dissolved	32
05504282	Water	12-Dec-05	CHROMIUM	10.2	UG/L		RA-MW-12A	Dissolved	86
104243	Water	7-Mar-06	CHROMIUM	9.6	UG/L		RA-MW-12A	Dissolved	60



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

### Well RA-MW-12B

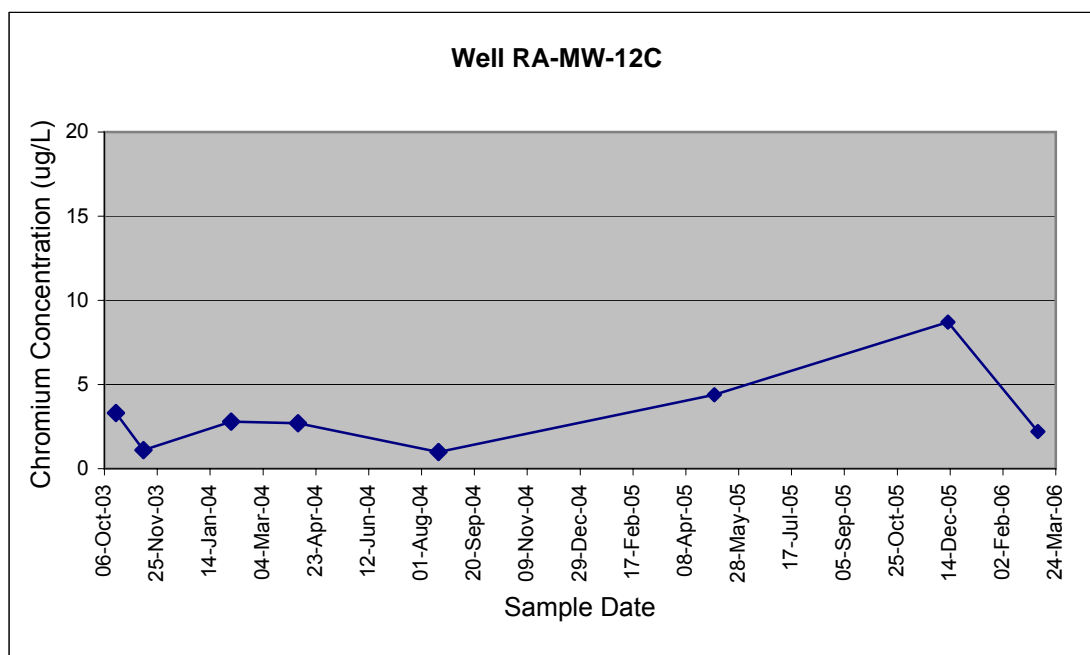
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2526	Water	17-Oct-03	CHROMIUM	9.3	UG/L	BJ	RA-MW-12B	Dissolved	>10
MJ27F7	Water	12-Nov-03	CHROMIUM	13.5	UG/L		RA-MW-12B	Dissolved	>10
MJ2AF1	Water	02-Feb-04	CHROMIUM	7.6	UG/L	J	RA-MW-12B	Total	6
MJ2BJ0	Water	06-Apr-04	CHROMIUM	3.3	UG/L	U	RA-MW-12B	Total	0
MJ4726	Water	17-Aug-04	CHROMIUM	4.2	UG/L	J	RA-MW-12B	Total	2
184254	Water	5-May-05	CHROMIUM	4.1	UG/L		RA-MW-12B	Total	4.5
05504283	Water	12-Dec-05	CHROMIUM	10.9	UG/L		RA-MW-12B	Total	8
104242	Water	7-Mar-06	CHROMIUM	3.3	UG/L		RA-MW-12B	Total	1.7



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

### Well RA-MW-12C

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2528	Water	17-Oct-03	CHROMIUM	3.3	UG/L	BJ	RA-MW-12C	Dissolved	>10
MJ27F9	Water	12-Nov-03	CHROMIUM	1.1	UG/L	BJ	RA-MW-12C	Dissolved	>10
MJ2AF2	Water	03-Feb-04	CHROMIUM	2.8	UG/L	J	RA-MW-12C	Total	1
MJ2BJ1	Water	06-Apr-04	CHROMIUM	2.7	UG/L	J	RA-MW-12C	Total	0
MJ4727	Water	17-Aug-04	CHROMIUM	0.98	UG/L	J	RA-MW-12C	Total	2
184255	Water	5-May-05	CHROMIUM	4.4	UG/L		RA-MW-12C	Total	5.2
05504284	Water	12-Dec-05	CHROMIUM	8.7	UG/L		RA-MW-12C	Total	3
104245	Water	7-Mar-06	CHROMIUM	2.2	UG/L		RA-MW-12C	Total	1

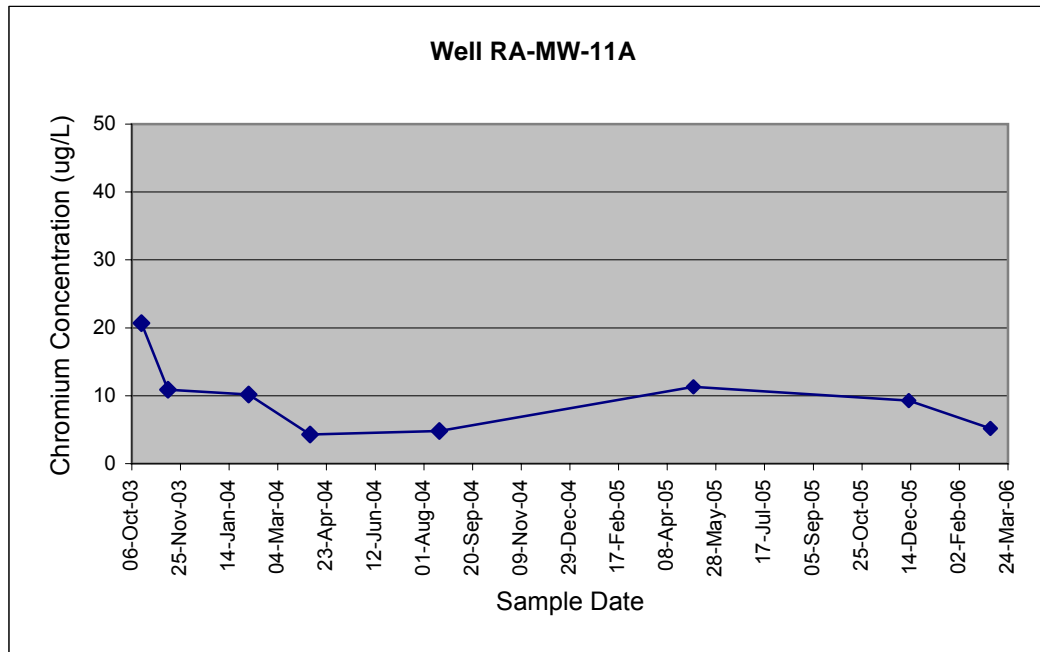


Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.



### Well RA-MW-11A

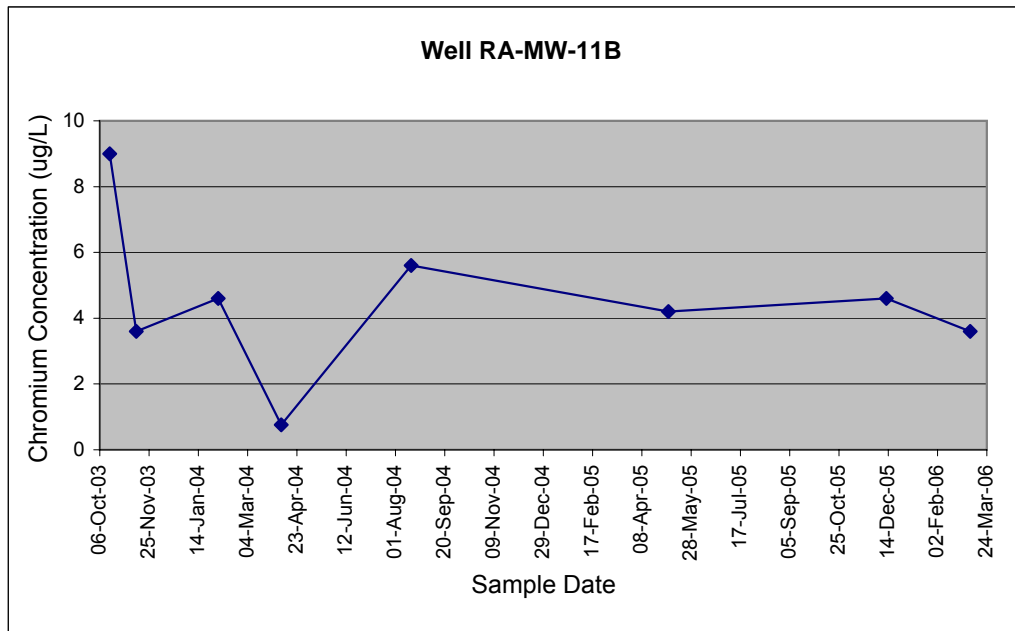
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2516	Water	16-Oct-03	CHROMIUM	20.7	UG/L		RA-MW-11A	Dissolved	>10
MJ27G1	Water	12-Nov-03	CHROMIUM	10.9	UG/L	J	RA-MW-11A	Dissolved	>10
MJ2AF4	Water	03-Feb-04	CHROMIUM	10.2	UG/L		RA-MW-11A	Dissolved	800
MJ2BJ3	Water	06-Apr-04	CHROMIUM	4.3	UG/L	J	RA-MW-11A	Dissolved	783
MJ4728	Water	17-Aug-04	CHROMIUM	4.8	UG/L	J	RA-MW-11A	Total	<10
184250	Water	5-May-05	CHROMIUM	11.3	UG/L		RA-MW-11A	Total	2
05504280	Water	12-Dec-05	CHROMIUM	9.3	UG/L		RA-MW-11A	Total	4
104232	Water	6-Mar-06	CHROMIUM	5.2	UG/L		RA-MW-11A	Total	1



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

### Well RA-MW-11B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2518	Water	16-Oct-03	CHROMIUM	9	UG/L	BJ	RA-MW-11B	Dissolved	>10
MJ27G3	Water	12-Nov-03	CHROMIUM	3.6	UG/L	BJ	RA-MW-11B	Dissolved	>10
MJ2AF6	Water	03-Feb-04	CHROMIUM	4.6	UG/L	J	RA-MW-11B	Dissolved	550
MJ2BJ5	Water	7-Apr-04	CHROMIUM	0.76	UG/L	J	RA-MW-11B	Dissolved	1100
MJ4730	Water	17-Aug-04	CHROMIUM	5.6	UG/L	J	RA-MW-11B	Total	114
184251	Water	5-May-05	CHROMIUM	4.2	UG/L		RA-MW-11B	Total	7.1
05504281	Water	12-Dec-05	CHROMIUM	4.6	UG/L		RA-MW-11B	Dissolved	13
104241	Water	7-Mar-06	CHROMIUM	3.6	UG/L		RA-MW-11B	Total	5

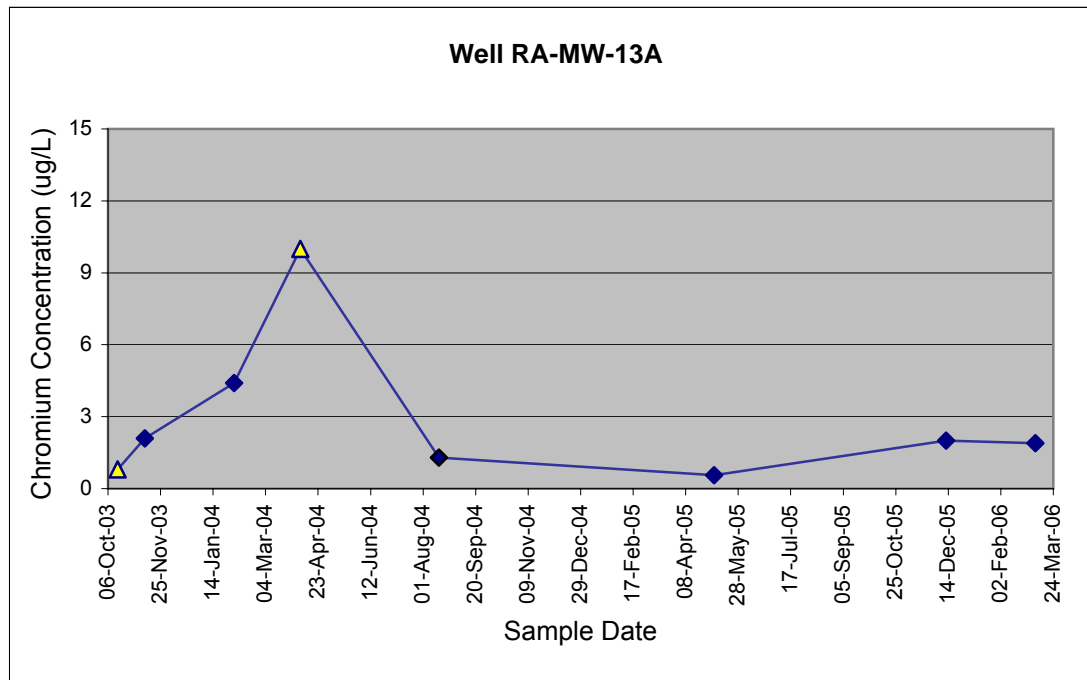


Note: The total Cr concentration was used for the August 2004 event because the dissolved concentration had a higher detection limit (10U).

Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

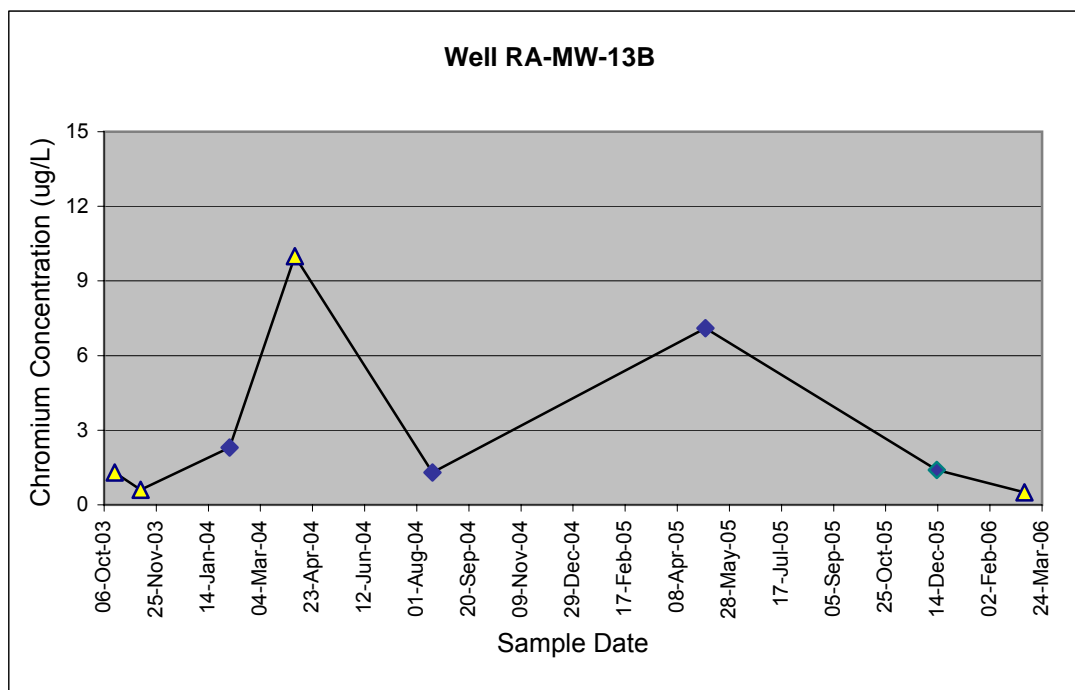
### Well RA-MW-13A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2508	Water	15-Oct-03	CHROMIUM	0.8	UG/L	U	RA-MW-13A	Total	<10
MJ27E2	Water	10-Nov-03	CHROMIUM	2.1	UG/L	BJ	RA-MW-13A	Total	>10
MJ2AG1	Water	03-Feb-04	CHROMIUM	4.4	UG/L	J	RA-MW-13A	Total	4
MJ2BH4	Water	6-Apr-04	CHROMIUM	10	UG/L	U	RA-MW-13A	Total	7
MJ4718	Water	16-Aug-04	CHROMIUM	1.3	UG/L	J	RA-MW-13A	Total	9
184261	Water	5-May-05	CHROMIUM	0.56	UG/L		RA-MW-13A	Total	6.4
05504285	Water	12-Dec-05	CHROMIUM	2	UG/L		RA-MW-13A	Total	6.4
104246	Water	7-Mar-06	CHROMIUM	1.9	UG/L		RA-MW-13A	Total	4



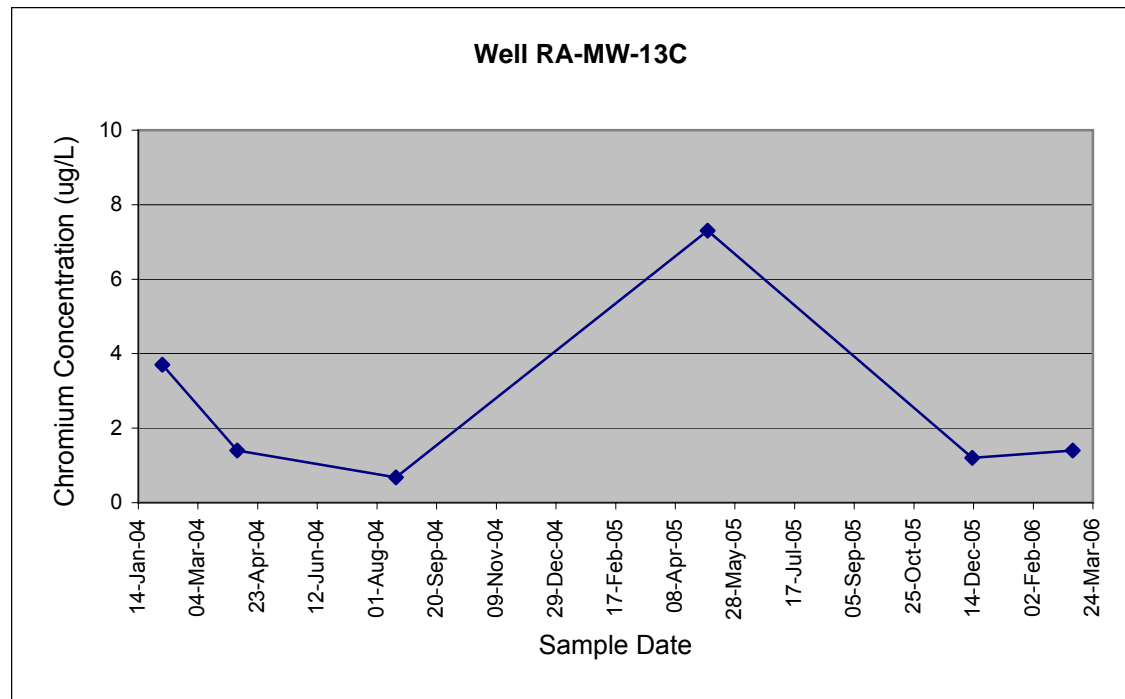
### Well RA-MW-13B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2509	Water	16-Oct-03	CHROMIUM	1.3	UG/L	U	RA-MW-13B	Total	<10
MJ27E3	Water	10-Nov-03	CHROMIUM	0.6	UG/L	UJ	RA-MW-13B	Total	<10
MJ2AF8	Water	03-Feb-04	CHROMIUM	2.3	UG/L	J	RA-MW-13B	Total	3
MJ2BH5	Water	6-Apr-04	CHROMIUM	10	UG/L	U	RA-MW-13B	Total	1
MJ4720	Water	16-Aug-04	CHROMIUM	1.3	UG/L	J	RA-MW-13B	Total	2
184262	Water	5-May-05	CHROMIUM	7.1	UG/L		RA-MW-13B	Total	2.8
05504286	Water	13-Dec-05	CHROMIUM	1.4	UG/L		RA-MW-13B	Total	1.7
104247	Water	7-Mar-06	CHROMIUM	0.5	UG/L	U	RA-MW-13B	Total	0



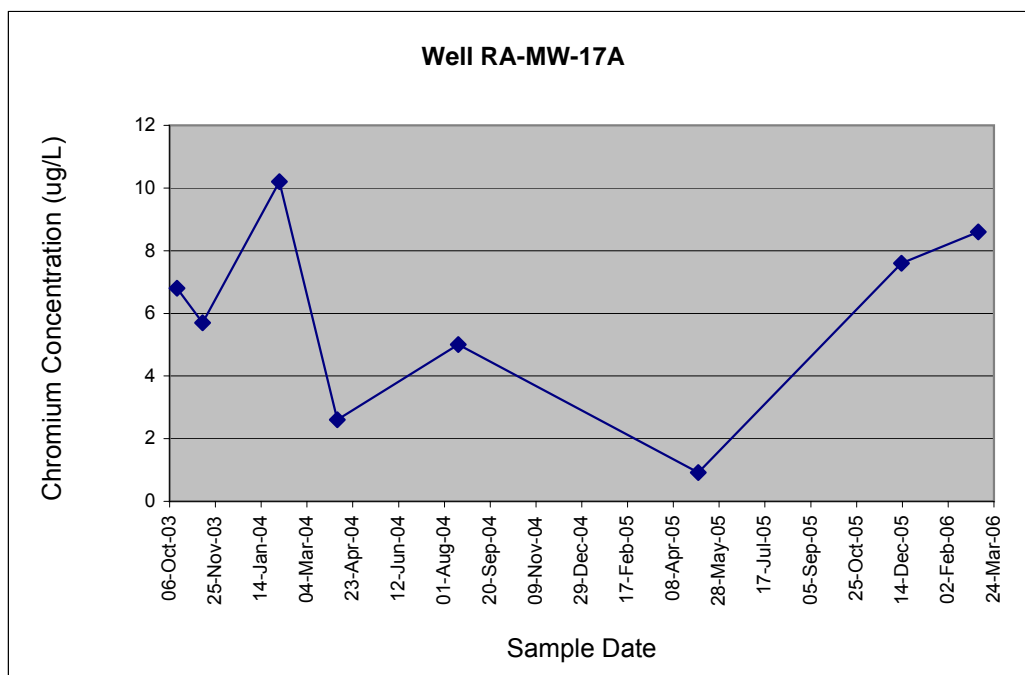
### Well RA-MW-13C

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AF9	Water	03-Feb-04	CHROMIUM	3.7	UG/L	J	RA-MW-13C	Total	2
MJ2BH6	Water	6-Apr-04	CHROMIUM	1.4	UG/L	J	RA-MW-13C	Total	0
MJ4721	Water	17-Aug-04	CHROMIUM	0.68	UG/L	J	RA-MW-13C	Total	2
184263	Water	5-May-05	CHROMIUM	7.3	UG/L		RA-MW-13C	Total	9.8
05504287	Water	13-Dec-05	CHROMIUM	1.2	UG/L		RA-MW-13C	Total	0.1
104248	Water	7-Mar-06	CHROMIUM	1.4	UG/L		RA-MW-13C	Total	6



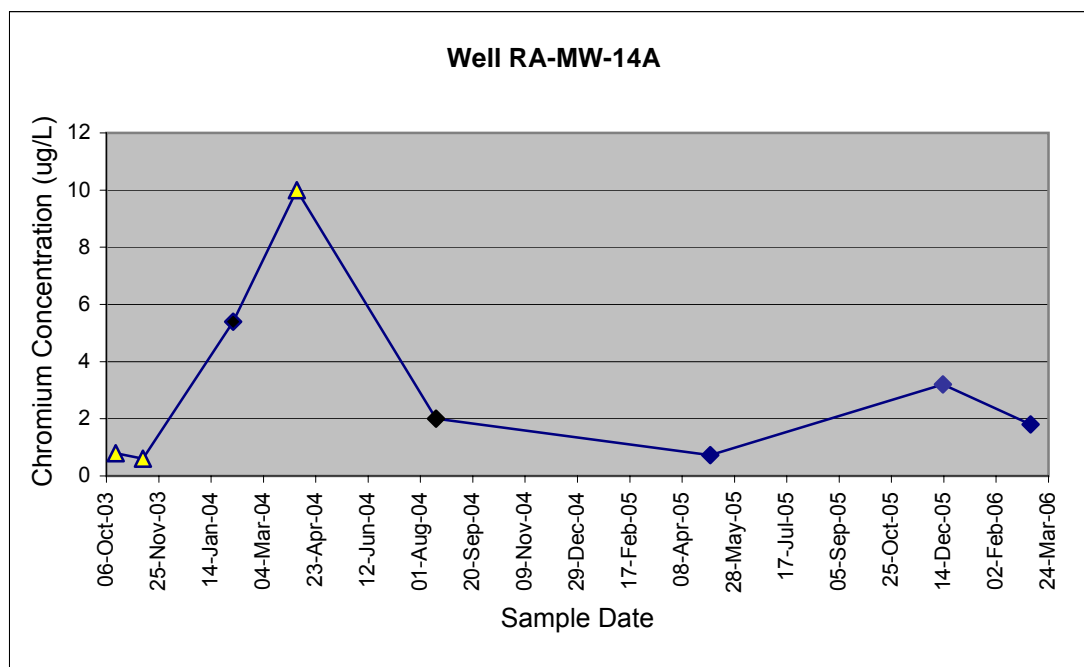
### Well RA-MW-17A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2501	Water	14-Oct-03	CHROMIUM	6.8	UG/L	BJ	RA-MW-17A	Total	<10
MJ27E5	Water	11-Nov-03	CHROMIUM	5.7	UG/L	BJ	RA-MW-17A	Total	<10
MJ2AG0	Water	03-Feb-04	CHROMIUM	10.2	UG/L	J	RA-MW-17A	Total	1
MJ2BH7	Water	6-Apr-04	CHROMIUM	2.6	UG/L	J	RA-MW-17A	Total	0
MJ4715	Water	16-Aug-04	CHROMIUM	5	UG/L	J	RA-MW-17A	Total	1
184260	Water	5-May-05	CHROMIUM	0.92	UG/L		RA-MW-17A	Total	10
05504299	Water	13-Dec-05	CHROMIUM	7.6	UG/L		RA-MW-17A	Total	3.1
104240	Water	7-Mar-06	CHROMIUM	8.6	UG/L		RA-MW-17A	Total	7



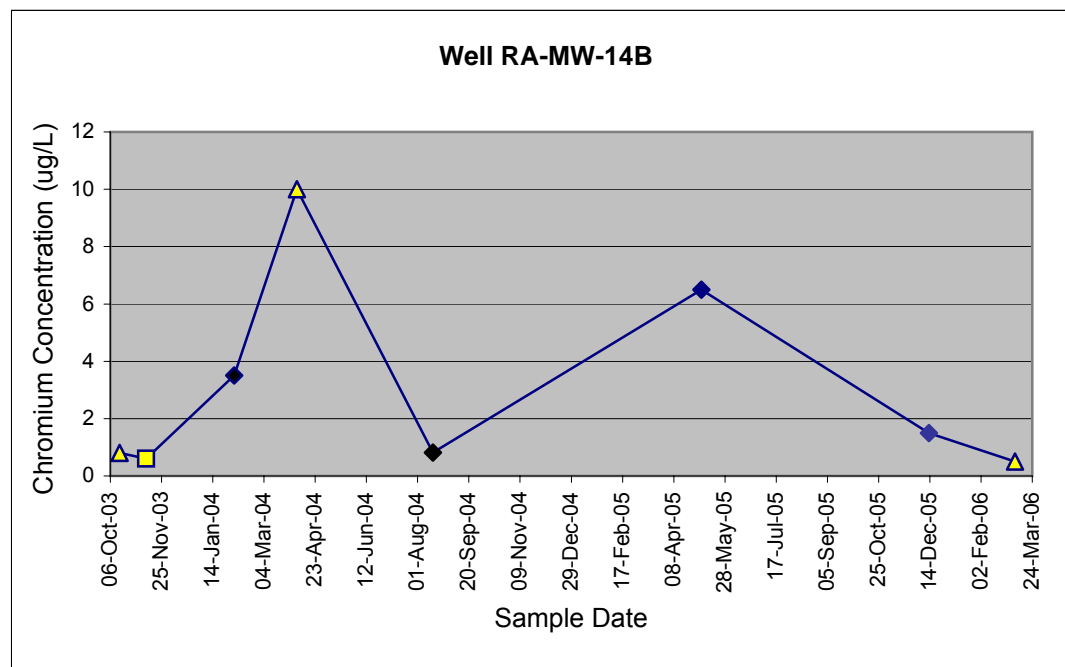
### Well RA-MW-14A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2504	Water	15-Oct-03	CHROMIUM	0.8	UG/L	U	RA-MW-14A	Total	<10
MJ27D8	Water	10-Nov-03	CHROMIUM	0.6	UG/L	UJ	RA-MW-14A	Total	<10
MJ2AG2	Water	04-Feb-04	CHROMIUM	5.4	UG/L	J	RA-MW-14A	Total	0
MJ2BG5	Water	5-Apr-04	CHROMIUM	10	UG/L	U	RA-MW-14A	Total	5
MJ4712	Water	16-Aug-04	CHROMIUM	2	UG/L	J	RA-MW-14A	Total	3
184258	Water	5-May-05	CHROMIUM	0.73	UG/L		RA-MW-14A	Total	7.5
05504294	Water	13-Dec-05	CHROMIUM	3.2	UG/L		RA-MW-14A	Total	1.5
104250	Water	7-Mar-06	CHROMIUM	1.8	UG/L		RA-MW-14A	Total	1



### Well RA-MW-14B

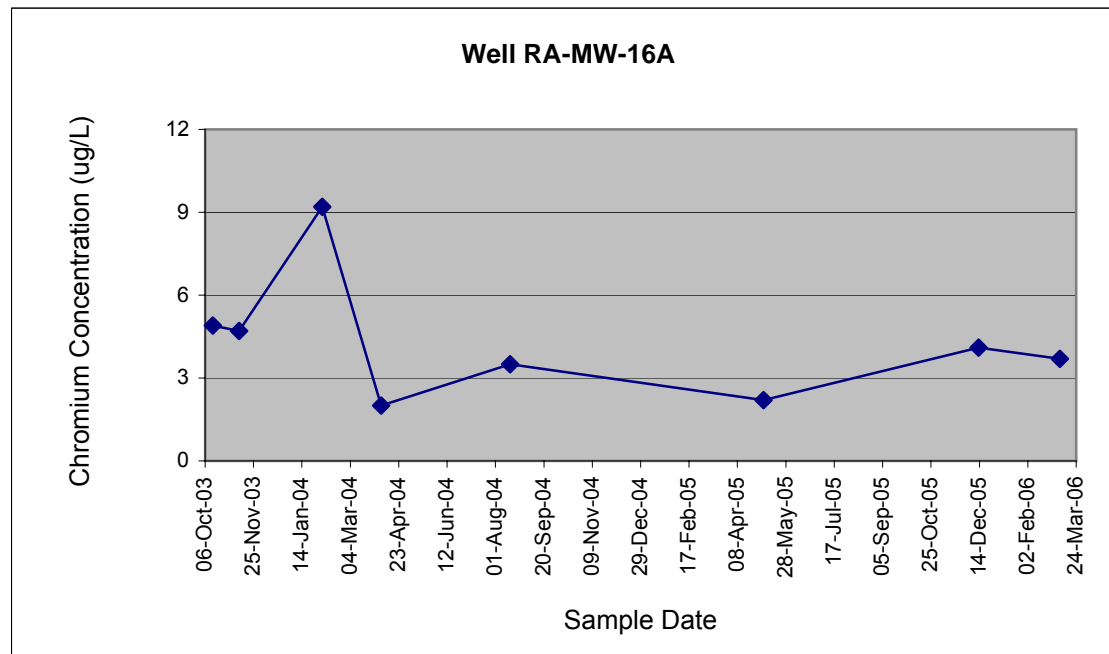
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2505	Water	15-Oct-03	CHROMIUM	0.8	UG/L	U	RA-MW-14B	Total	<10
MJ27D9	Water	10-Nov-03	CHROMIUM	0.6	UG/L	R	RA-MW-14B	Total	<10
MJ2AG4	Water	04-Feb-04	CHROMIUM	3.5	UG/L	J	RA-MW-14B	Total	1
MJ2BG7	Water	5-Apr-04	CHROMIUM	10	UG/L	U	RA-MW-14B	Total	0
MJ4714	Water	16-Aug-04	CHROMIUM	0.81	UG/L	J	RA-MW-14B	Total	2
184259	Water	5-May-05	CHROMIUM	6.5	UG/L		RA-MW-14B	Total	5.6
05504295	Water	13-Dec-05	CHROMIUM	1.5	UG/L		RA-MW-14B	Total	6.1
104249	Water	7-Mar-06	CHROMIUM	0.5	UG/L	U	RA-MW-14B	Total	4





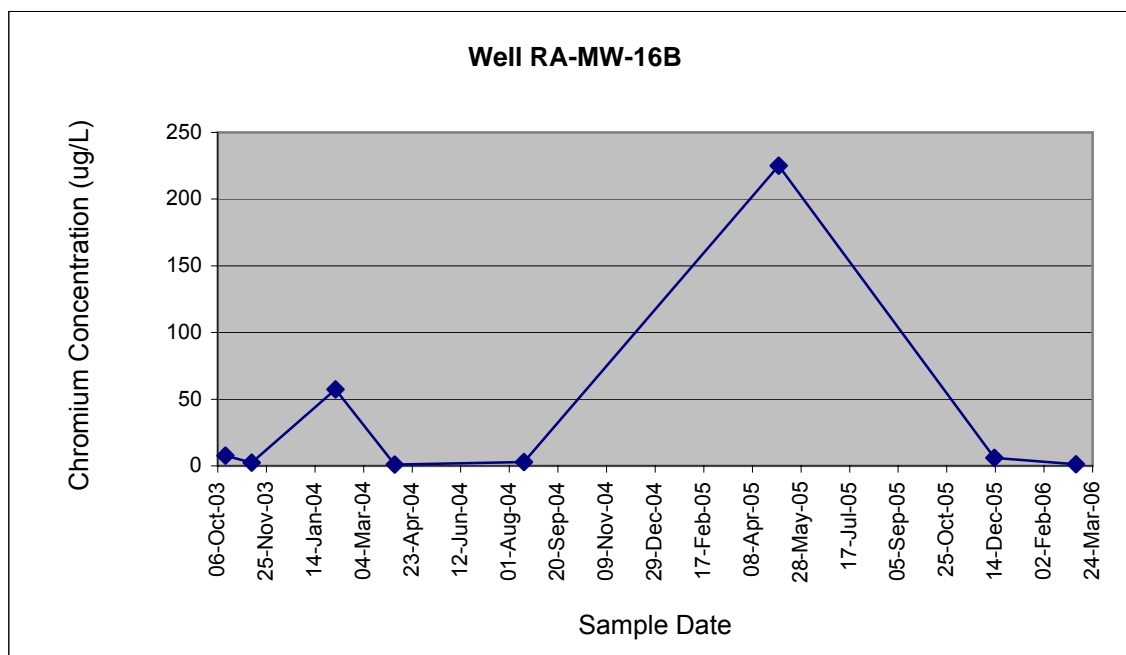
### Well RA-MW-16A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2502	Water	14-Oct-03	CHROMIUM	4.9	UG/L	BJ	RA-MW-16A	Total	<10
MJ27E0	Water	10-Nov-03	CHROMIUM	4.7	UG/L	BJ	RA-MW-16A	Total	<10
MJ2AG5	Water	04-Feb-04	CHROMIUM	9.2	UG/L	J	RA-MW-16A	Total	1
MJ2BG8	Water	5-Apr-04	CHROMIUM	2	UG/L	J	RA-MW-16A	Total	1
MJ4716	Water	16-Aug-04	CHROMIUM	3.5	UG/L	J	RA-MW-16A	Total	2
184257	Water	5-May-05	CHROMIUM	2.2	UG/L		RA-MW-16A	Total	8.5
05504293	Water	13-Dec-05	CHROMIUM	4.1	UG/L		RA-MW-16A	Total	1.2
104238	Water	7-Mar-06	CHROMIUM	3.7	UG/L		RA-MW-16A	Total	1.7



### Well RA-MW-16B

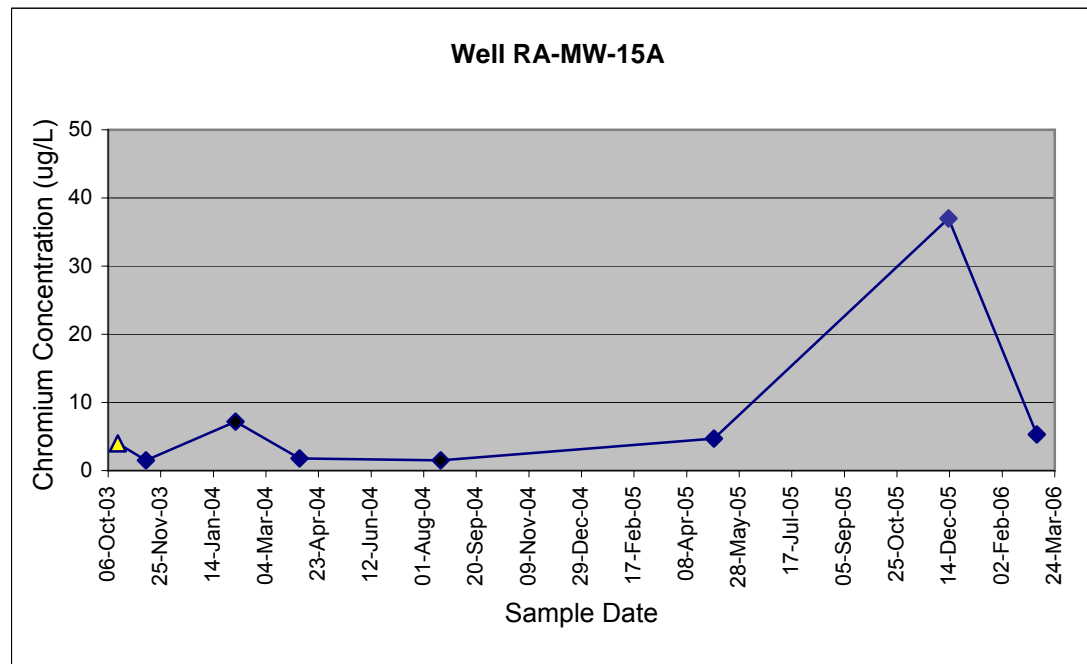
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2503	Water	14-Oct-03	CHROMIUM	7.6	UG/L	BJ	RA-MW-16B	Total	<10
MJ27E1	Water	10-Nov-03	CHROMIUM	2.5	UG/L	BJ	RA-MW-16B	Total	<10
MJ2AG6	Water	04-Feb-04	CHROMIUM	57.4	UG/L	BJ	RA-MW-16B	Total	1
MJ2BH0	Water	5-Apr-04	CHROMIUM	1	UG/L	J	RA-MW-16B	Dissolved	0
MJ4717	Water	16-Aug-04	CHROMIUM	2.8	UG/L	J	RA-MW-16B	Total	3.6
184256	Water	5-May-05	CHROMIUM	225	UG/L		RA-MW-16B	Total	5.7
05504291	Water	13-Dec-05	CHROMIUM	6.1	UG/L		RA-MW-16B	Dissolved	3.9
104239	Water	7-Mar-06	CHROMIUM	1.3	UG/L		RA-MW-16B	Total	0



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

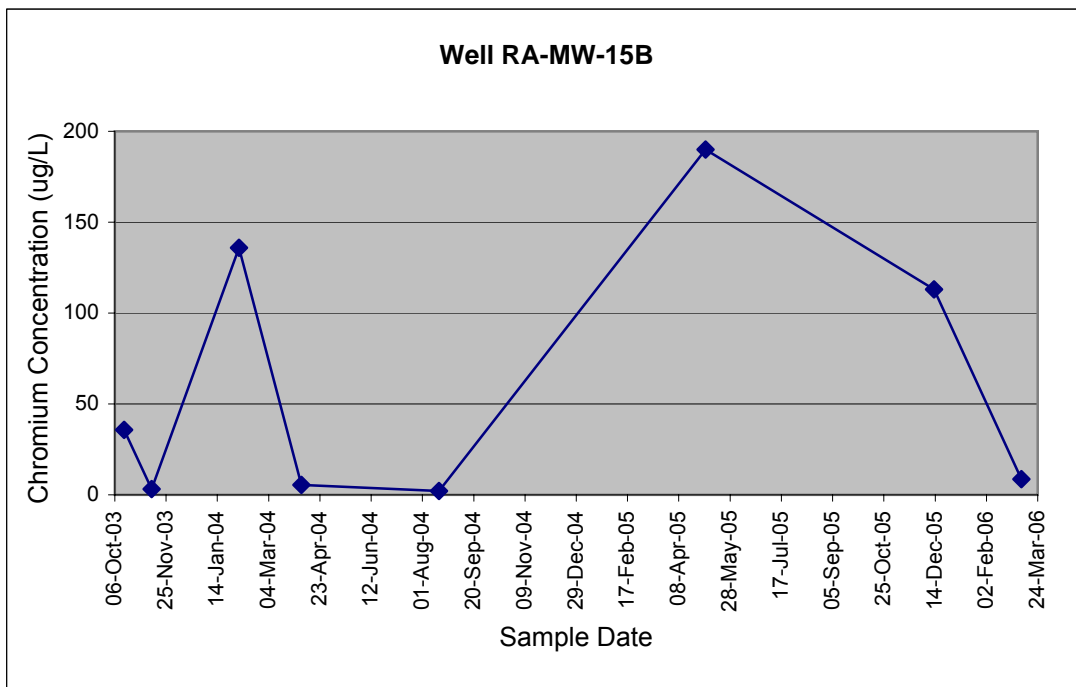
### Well RA-MW-15A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2506	Water	15-Oct-03	CHROMIUM	4	UG/L	U	RA-MW-15A	Total	<10
MJ27E8	Water	11-Nov-03	CHROMIUM	1.5	UG/L	BJ	RA-MW-15A	Total	<10
MJ2AG7	Water	04-Feb-04	CHROMIUM	7.2	UG/L	J	RA-MW-15A	Total	1
MJ2BH1	Water	5-Apr-04	CHROMIUM	1.8	UG/L	J	RA-MW-15A	Total	0
MJ4722	Water	17-Aug-04	CHROMIUM	1.5	UG/L	J	RA-MW-15A	Total	0
184248	Water	4-May-05	CHROMIUM	4.7	UG/L		RA-MW-15A	Total	2
05504290	Water	13-Dec-05	CHROMIUM	37	UG/L		RA-MW-15A	Total	1.3
104251	Water	7-Mar-06	CHROMIUM	5.3	UG/L		RA-MW-15A	Total	0



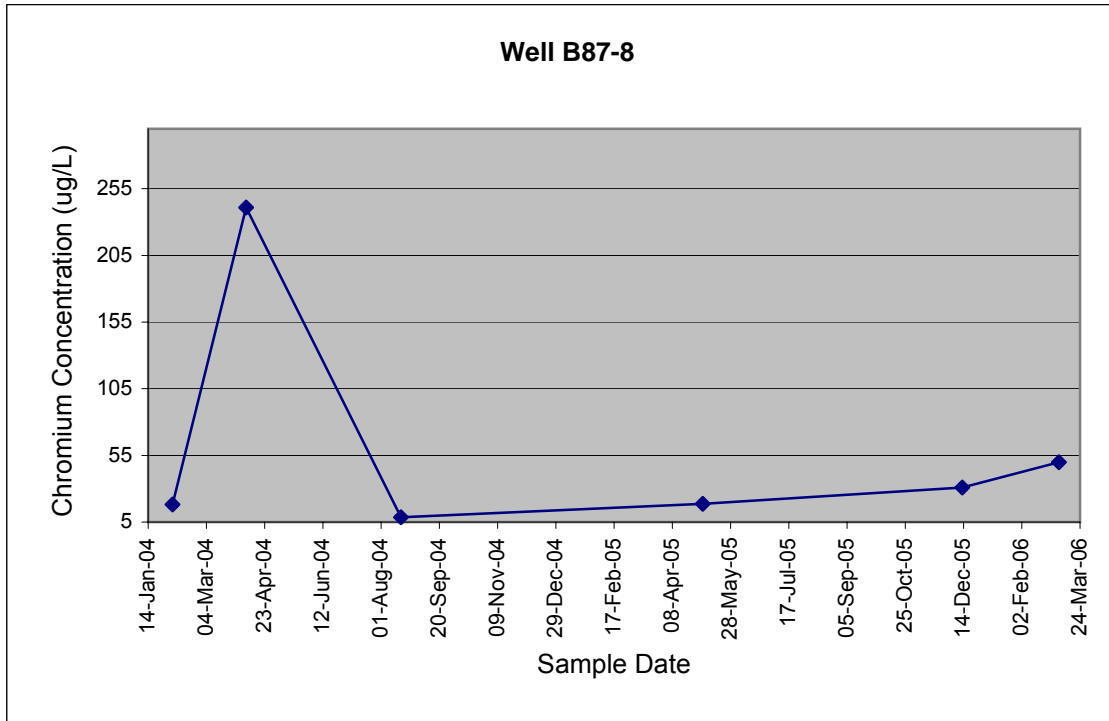
### Well RA-MW-15B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2507	Water	15-Oct-03	CHROMIUM	35.8	UG/L		RA-MW-15B	Total	<10
MJ27E9	Water	11-Nov-03	CHROMIUM	3.2	UG/L	BJ	RA-MW-15B	Total	<10
MJ2AG8	Water	04-Feb-04	CHROMIUM	136	UG/L		RA-MW-15B	Total	2
MJ2BH2	Water	5-Apr-04	CHROMIUM	5.5	UG/L	J	RA-MW-15B	Total	0
MJ4723	Water	17-Aug-04	CHROMIUM	2.2	UG/L	J	RA-MW-15B	Total	1
184249	Water	4-May-05	CHROMIUM	190	UG/L		RA-MW-15B	Total	9.7
05504288	Water	13-Dec-05	CHROMIUM	113	UG/L		RA-MW-15B	Total	3.5
104252	Water	8-Mar-06	CHROMIUM	8.7	UG/L		RA-MW-15B	Dissolved	5



### Well B87-8

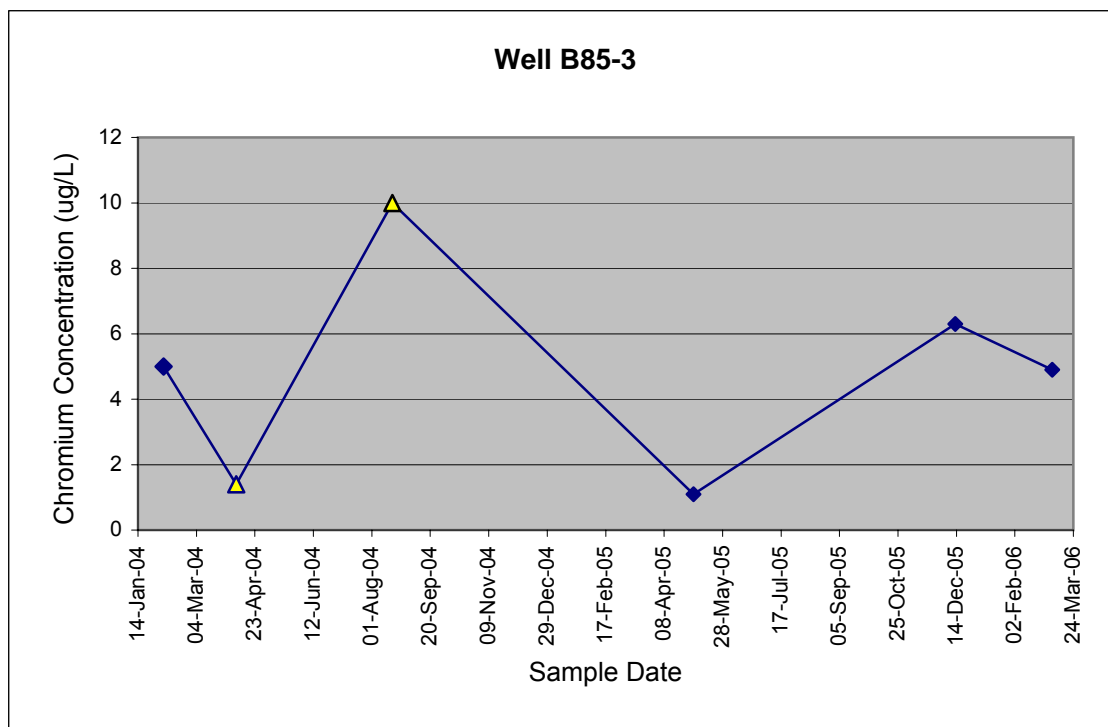
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AG9	Water	04-Feb-04	CHROMIUM	18.2	UG/L		B87-8	Total	2
MJ2BK0	Water	7-Apr-04	CHROMIUM	241	UG/L		B87-8	Total	8
MJ4737	Water	18-Aug-04	CHROMIUM	8.5	UG/L	J	B87-8	Dissolved	36
184247	Water	4-May-05	CHROMIUM	18.8	UG/L		B87-8	Total	6.5
05504297	Water	13-Dec-05	CHROMIUM	31	UG/L		B87-8	Total	5.1
104236	Water	6-Mar-06	CHROMIUM	50	UG/L		B87-8	Total	8



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

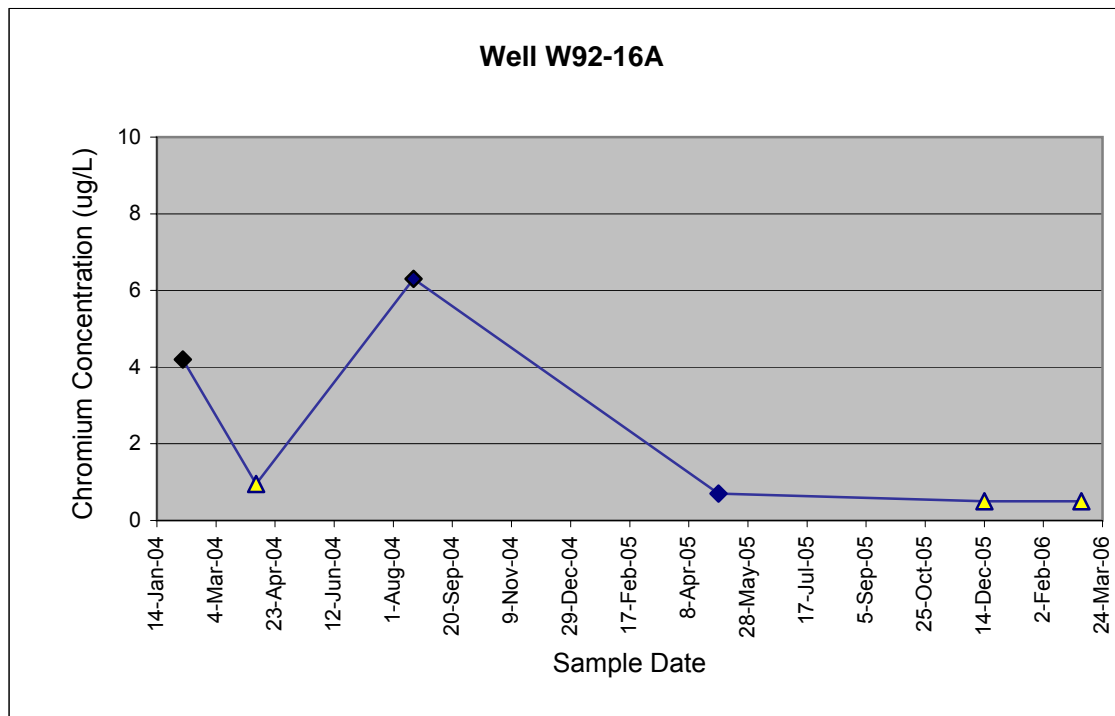
### Well B85-3

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH0	Water	05-Feb-04	CHROMIUM	5	UG/L	J	B85-3	Total	1
MJ2BJ6	Water	7-Apr-04	CHROMIUM	1.4	UG/L	U	B85-3	Total	3
MJ4732	Water	18-Aug-04	CHROMIUM	10	UG/L	U	B85-3	Total	0
184232	Water	3-May-05	CHROMIUM	1.1	UG/L		B85-3	Total	2.8
05504298	Water	13-Dec-05	CHROMIUM	6.3	UG/L		B85-3	Total	8.1
104235	Water	6-Mar-06	CHROMIUM	4.9	UG/L		B85-3	Total	7



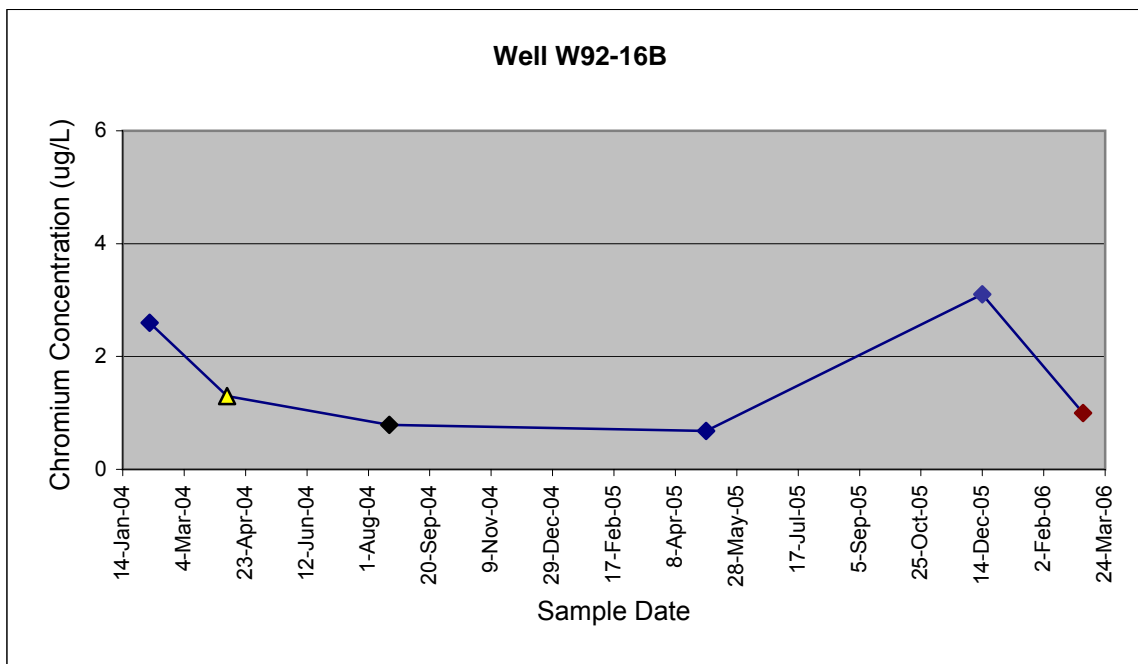
### Well W92-16A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH1	Water	05-Feb-04	CHROMIUM	4.2	UG/L	J	W92-16A	Total	2
MJ2BJ7	Water	7-Apr-04	CHROMIUM	0.95	UG/L	U	W92-16A	Total	0
MJ4734	Water	18-Aug-04	CHROMIUM	6.3	UG/L	J	W92-16A	Total	0
184234	Water	3-May-05	CHROMIUM	0.7	UG/L		W92-16A	Total	0.7
05504311	Water	14-Dec-05	CHROMIUM	0.5	UG/L	U	W92-16A	Total	0.7
104234	Water	6-Mar-06	CHROMIUM	0.5	UG/L	U	W92-16A	Total	0.7



# Well W92-16B

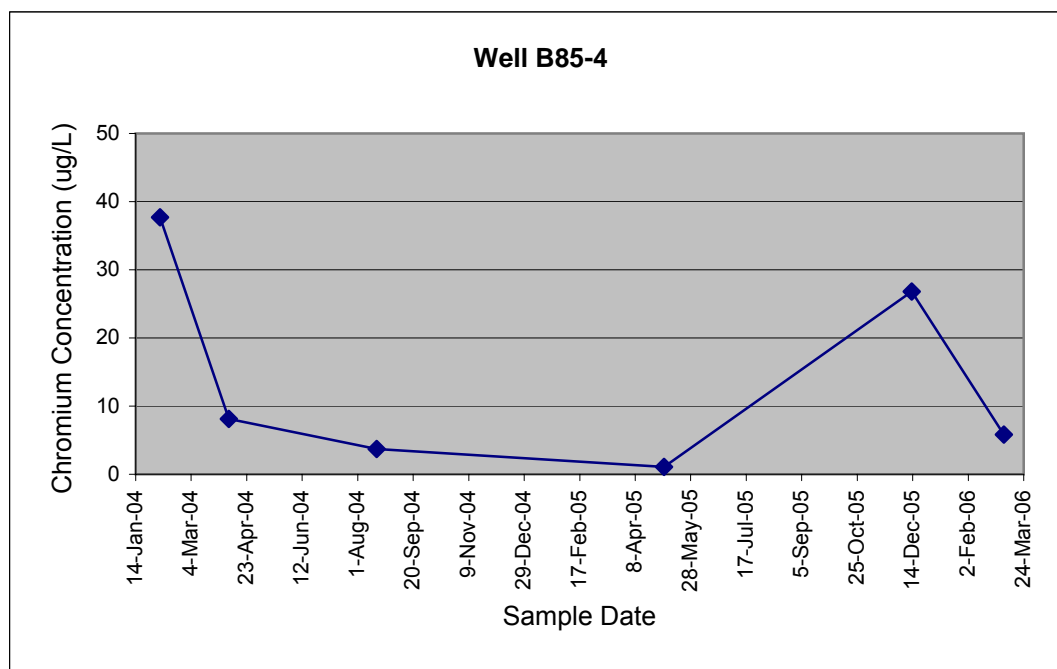
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH3	Water	05-Feb-04	CHROMIUM	2.6	UG/L	J	W92-16B	Total	7
MJ2BJ8	Water	7-Apr-04	CHROMIUM	1.3	UG/L	U	W92-16B	Total	2
MJ4735	Water	18-Aug-04	CHROMIUM	0.79	UG/L	J	W92-16B	Total	<10
184233	Water	3-May-05	CHROMIUM	0.68	UG/L		W92-16B	Total	3.9
05504312	Water	14-Dec-05	CHROMIUM	3.1	UG/L		W92-16B	Total	5.1
104233	Water	6-Mar-06	CHROMIUM	1	UG/L		W92-16B	Total	8.7





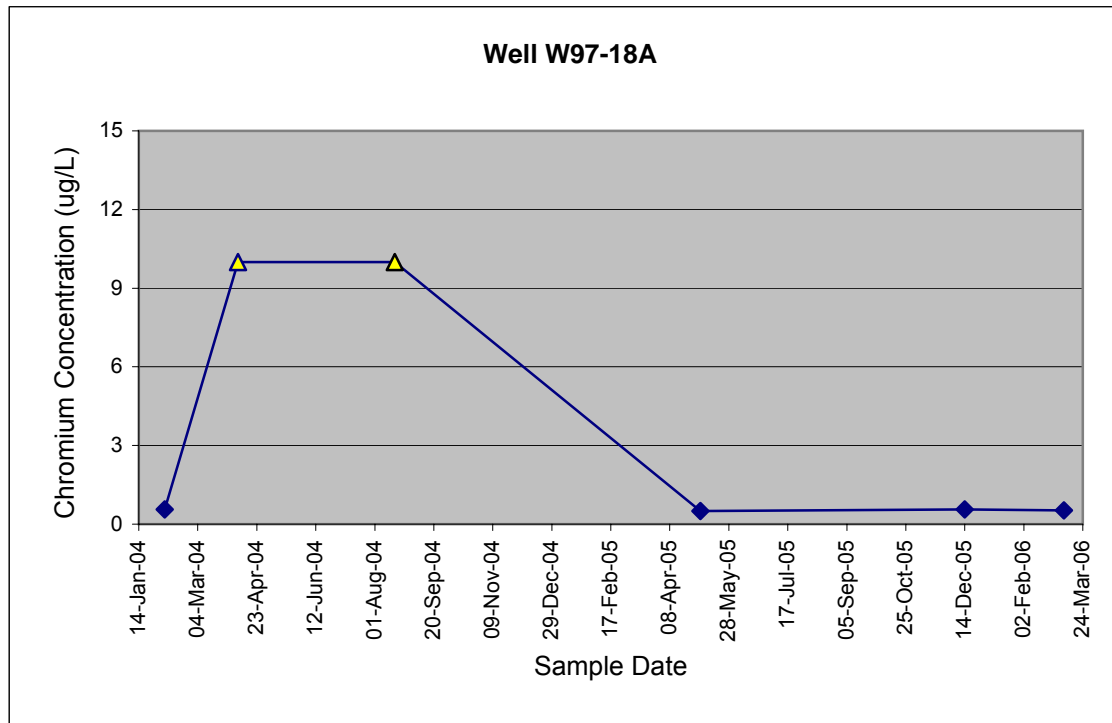
### Well B85-4

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH4	Water	05-Feb-04	CHROMIUM	37.7	UG/L		B85-4	Total	1
MJ2BK1	Water	7-Apr-04	CHROMIUM	8.1	UG/L	J	B85-4	Total	0
MJ4738	Water	18-Aug-04	CHROMIUM	3.7	UG/L	J	B85-4	Total	4
184246	Water	4-May-05	CHROMIUM	1.1	UG/L		B85-4	Total	2
05504296	Water	13-Dec-05	CHROMIUM	26.8	UG/L		B85-4	Total	5.7
104237	Water	6-Mar-06	CHROMIUM	5.8	UG/L		B85-4	Total	3.9



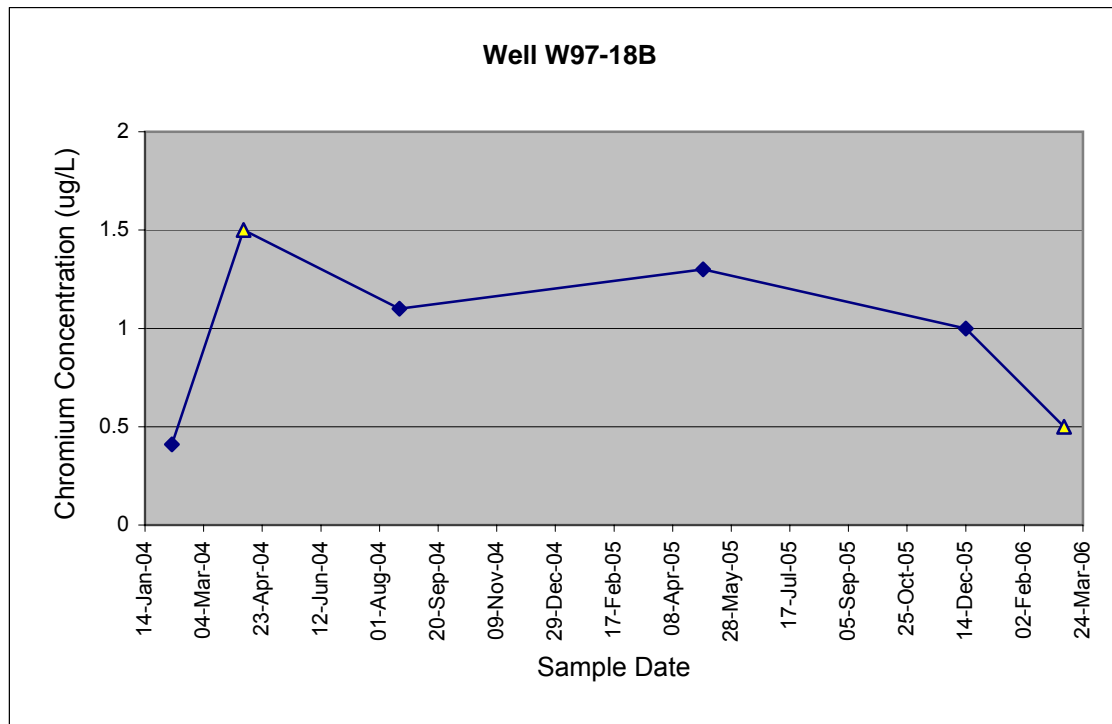
# Well W97-18A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH5	Water	05-Feb-04	CHROMIUM	0.56	UG/L	J	W97-18A	Total	14
MJ2BK2	Water	7-Apr-04	CHROMIUM	10	UG/L	U	W97-18A	Total	0
MJ4739	Water	18-Aug-04	CHROMIUM	10	UG/L	U	W97-18A	Total	5
184244	Water	4-May-05	CHROMIUM	0.5	UG/L		W97-18A	Total	1
05504300	Water	14-Dec-05	CHROMIUM	0.56	UG/L		W97-18A	Total	4
104256	Water	8-Mar-06	CHROMIUM	0.53	UG/L		W97-18A	Total	0



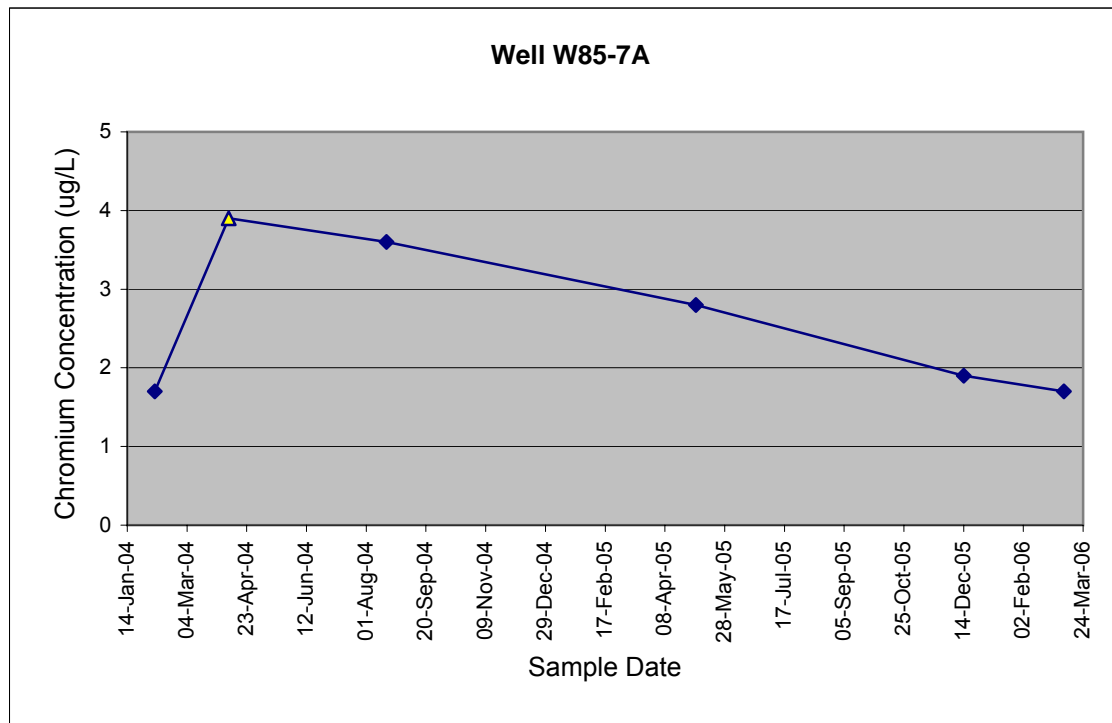
### Well W97-18B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH7	Water	06-Feb-04	CHROMIUM	0.41	UG/L	J	W97-18B	Total	2
MJ2BK3	Water	7-Apr-04	CHROMIUM	1.5	UG/L	U	W97-18B	Total	0
MJ4740	Water	18-Aug-04	CHROMIUM	1.1	UG/L	J	W97-18B	Total	5
184245	Water	4-May-05	CHROMIUM	1.3	UG/L		W97-18B	Total	1.1
05504301	Water	14-Dec-05	CHROMIUM	1	UG/L		W97-18B	Total	1.1
104257	Water	8-Mar-06	CHROMIUM	0.5	UG/L	U	W97-18B	Total	1.4



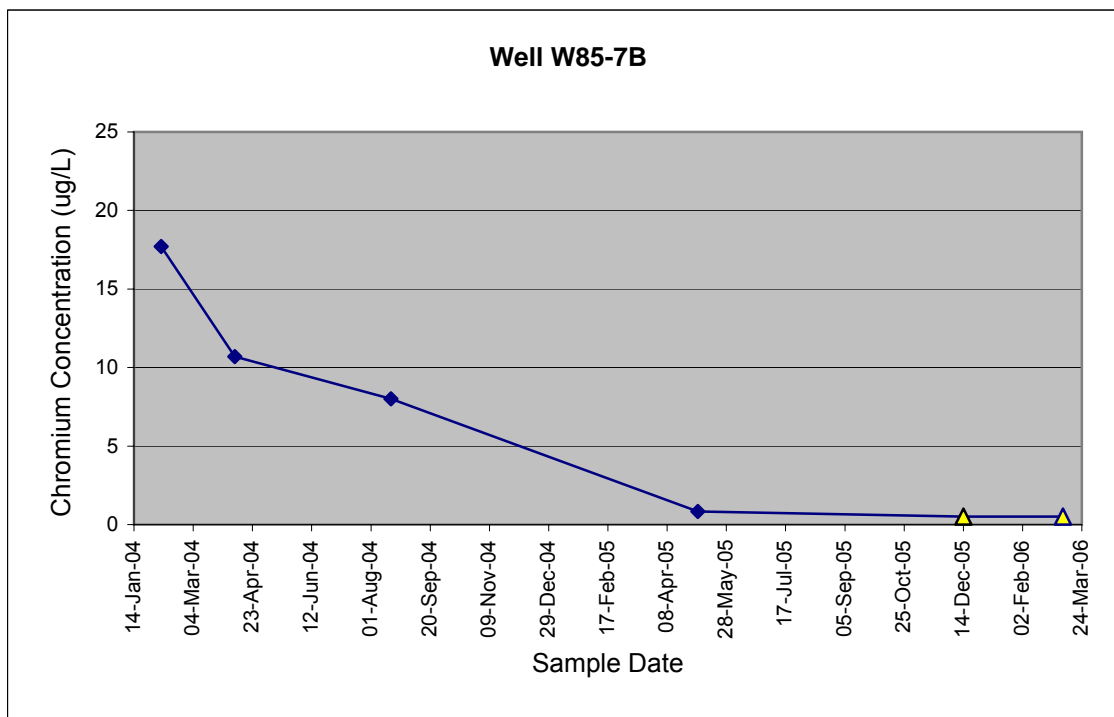
### Well W85-7A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH8	Water	06-Feb-04	CHROMIUM	1.7	UG/L	J	W85-7A	Total	1
MJ2BK6	Water	8-Apr-04	CHROMIUM	3.9	UG/L	U	W85-7A	Total	0
MJ4741	Water	18-Aug-04	CHROMIUM	3.6	UG/L	J	W85-7A	Total	3
184239	Water	4-May-05	CHROMIUM	2.8	UG/L		W85-7A	Total	0.5
05504307	Water	14-Dec-05	CHROMIUM	1.9	UG/L		W85-7A	Total	0.2
104254	Water	8-Mar-06	CHROMIUM	1.7	UG/L		W85-7A	Total	0



### Well W85-7B

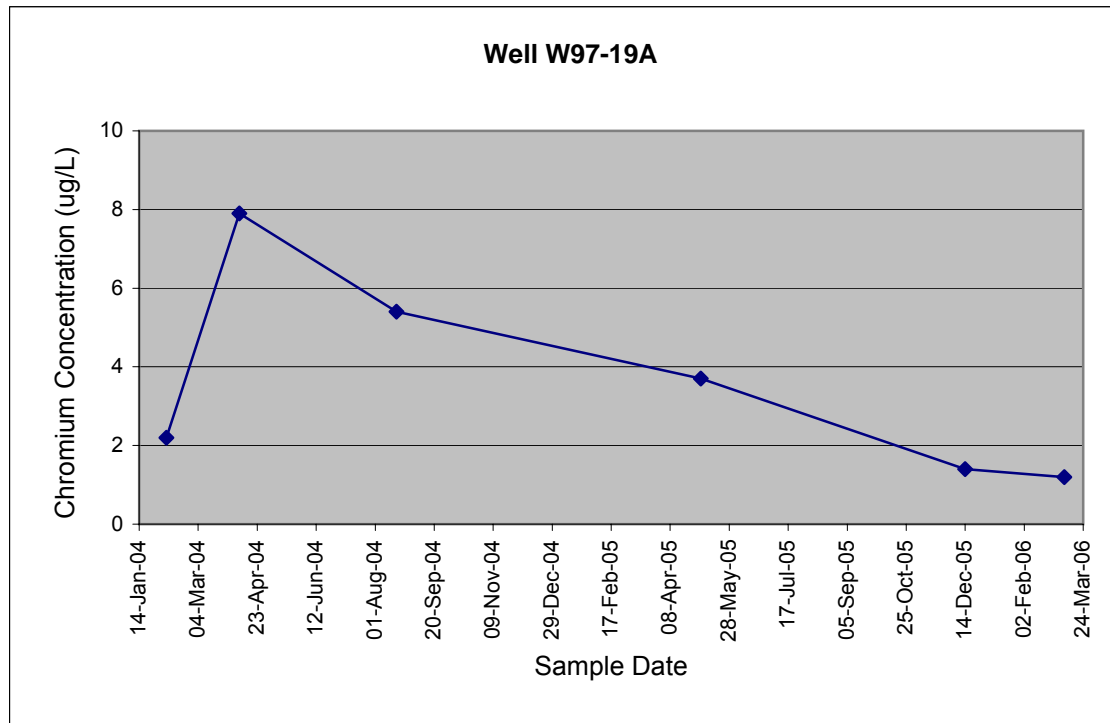
Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AH9	Water	06-Feb-04	CHROMIUM	17.7	UG/L		W85-7B	Total	3
MJ2BK7	Water	8-Apr-04	CHROMIUM	10.7	UG/L		W85-7B	Total	0
MJ4742	Water	18-Aug-04	CHROMIUM	8	UG/L	J	W85-7B	Total	25
184240	Water	4-May-05	CHROMIUM	0.84	UG/L		W85-7B	Total	6.7
05504308	Water	14-Dec-05	CHROMIUM	0.5	UG/L	U	W85-7B	Total	1.4
104255	Water	8-Mar-06	CHROMIUM	0.5	UG/L	U	W85-7B	Total	0



Note: Although turbidity was greater than 10 NTU, no filtered sample was collected.

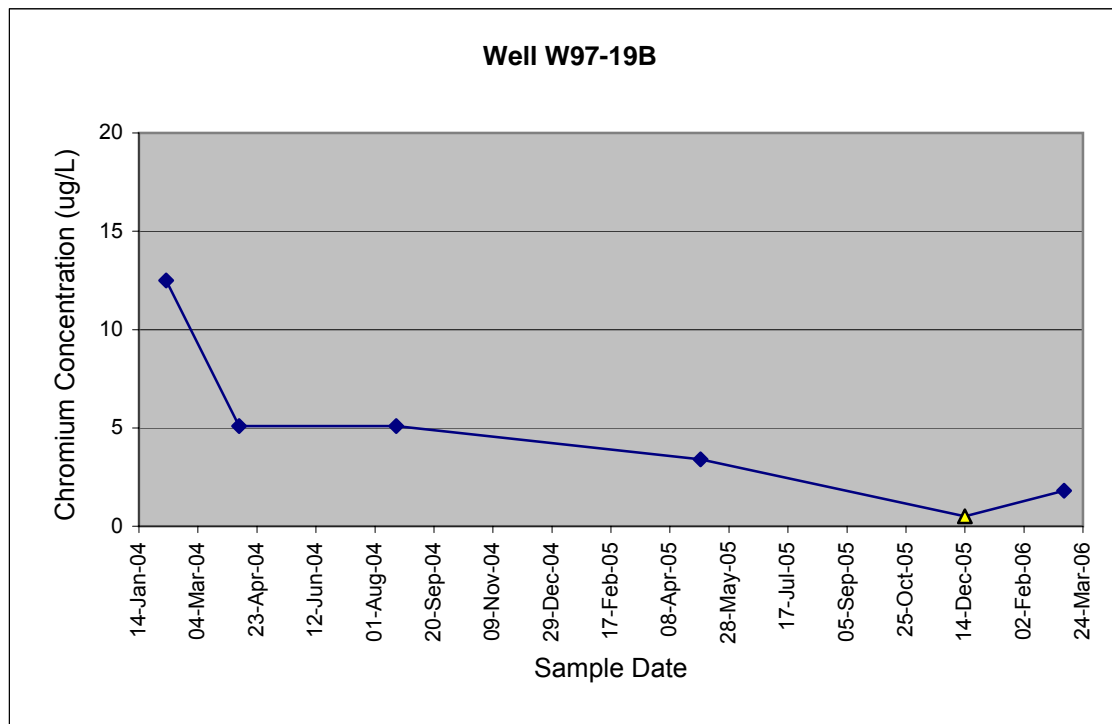
### Well W97-19A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ0	Water	06-Feb-04	CHROMIUM	2.2	UG/L	J	W97-19A	Total	7
MJ2BK4	Water	8-Apr-04	CHROMIUM	7.9	UG/L	J	W97-19A	Total	2
MJ4749	Water	19-Aug-04	CHROMIUM	5.4	UG/L	J	W97-19A	Total	8
184242	Water	4-May-05	CHROMIUM	3.7	UG/L		W97-19A	Total	1.8
05504303	Water	14-Dec-05	CHROMIUM	1.4	UG/L		W97-19A	Total	0
104259	Water	8-Mar-06	CHROMIUM	1.2	UG/L		W97-19A	Total	1



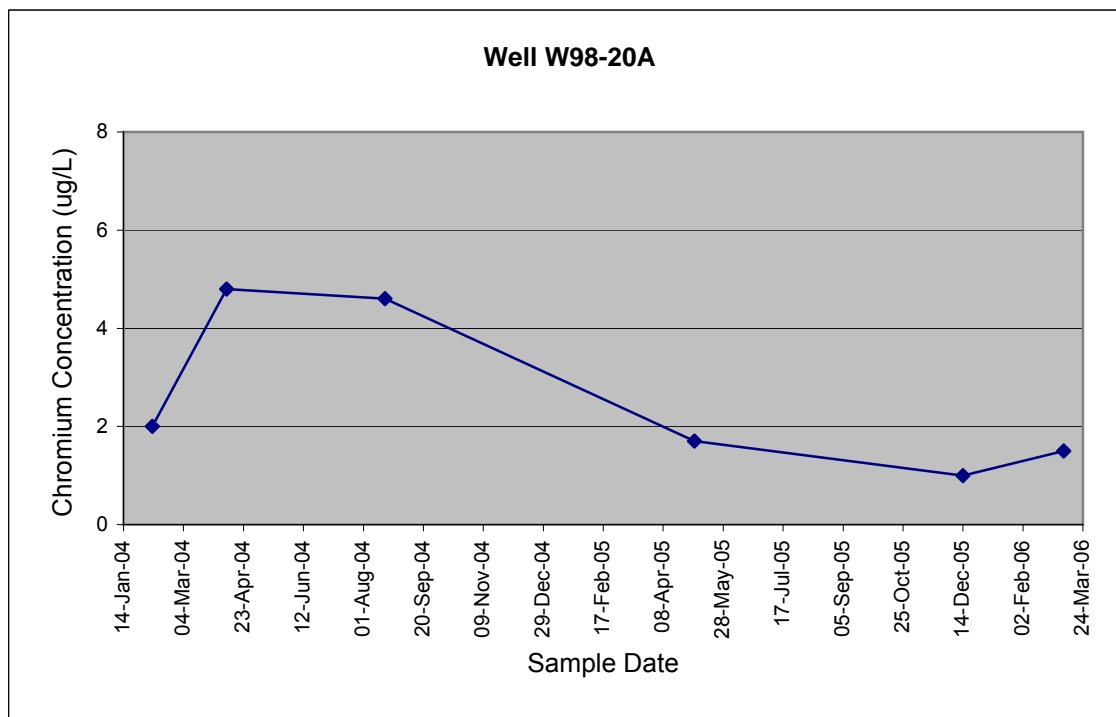
### Well W97-19B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ1	Water	06-Feb-04	CHROMIUM	12.5	UG/L	J	W97-19B	Total	0
MJ2BK5	Water	8-Apr-04	CHROMIUM	5.1	UG/L	J	W97-19B	Total	1
MJ4750	Water	19-Aug-04	CHROMIUM	5.1	UG/L	J	W97-19B	Total	3
184243	Water	4-May-05	CHROMIUM	3.4	UG/L		W97-19B	Total	1
05504304	Water	14-Dec-05	CHROMIUM	0.5	UG/L	U	W97-19B	Total	0
104260	Water	8-Mar-06	CHROMIUM	1.8	UG/L		W97-19B	Total	5



### Well W98-20A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ2	Water	07-Feb-04	CHROMIUM	2	UG/L	J	W98-20A	Total	1
MJ2BL2	Water	9-Apr-04	CHROMIUM	4.8	UG/L	J	W98-20A	Total	0
MJ4752	Water	19-Aug-04	CHROMIUM	4.6	UG/L	J	W98-20A	Dissolved	20
184241	Water	4-May-05	CHROMIUM	1.7	UG/L		W98-20A	Total	0.5
05504302	Water	14-Dec-05	CHROMIUM	1	UG/L		W98-20A	Total	0
104258	Water	8-Mar-06	CHROMIUM	1.5	UG/L		W98-20A	Total	0

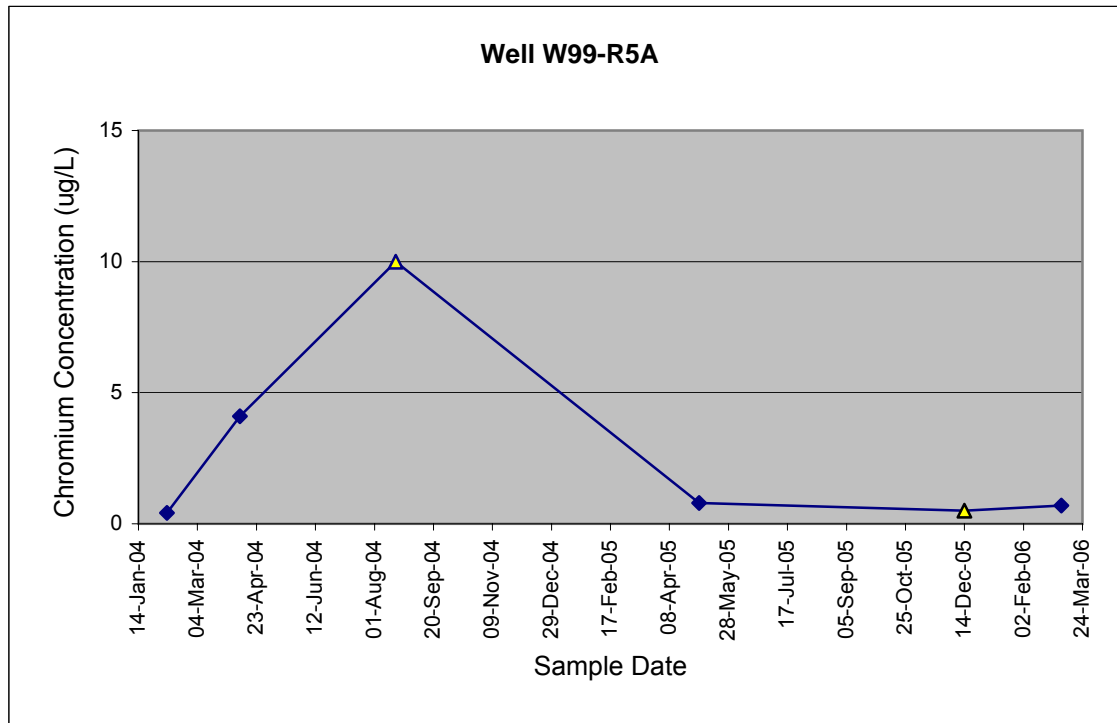


Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.



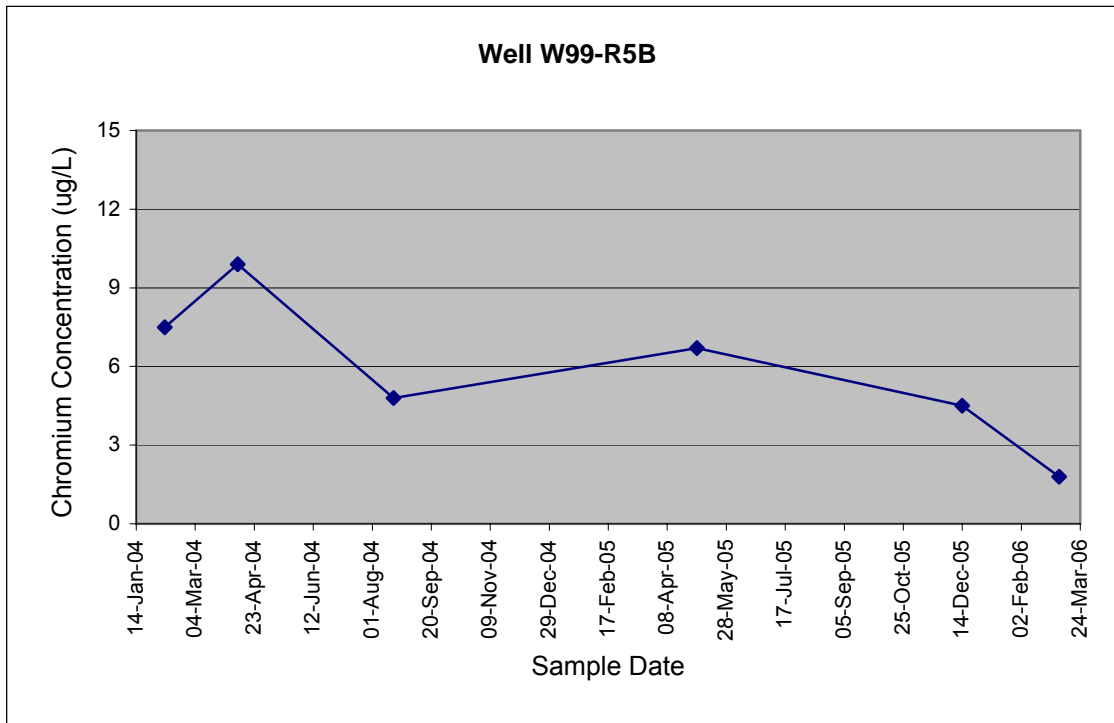
### Well W99-R5A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ3	Water	07-Feb-04	CHROMIUM	0.41	UG/L	J	W99-R5A	Total	0
MJ2BL3	Water	9-Apr-04	CHROMIUM	4.1	UG/L	J	W99-R5A	Total	0
MJ4745	Water	19-Aug-04	CHROMIUM	10	UG/L	U	W99-R5A	Total	10
184230	Water	3-May-05	CHROMIUM	0.79	UG/L		W99-R5A	Total	1
05504305	Water	14-Dec-05	CHROMIUM	0.5	UG/L	U	W99-R5A	Total	0
104230	Water	6-Mar-06	CHROMIUM	0.7	UG/L		W99-R5A	Total	0



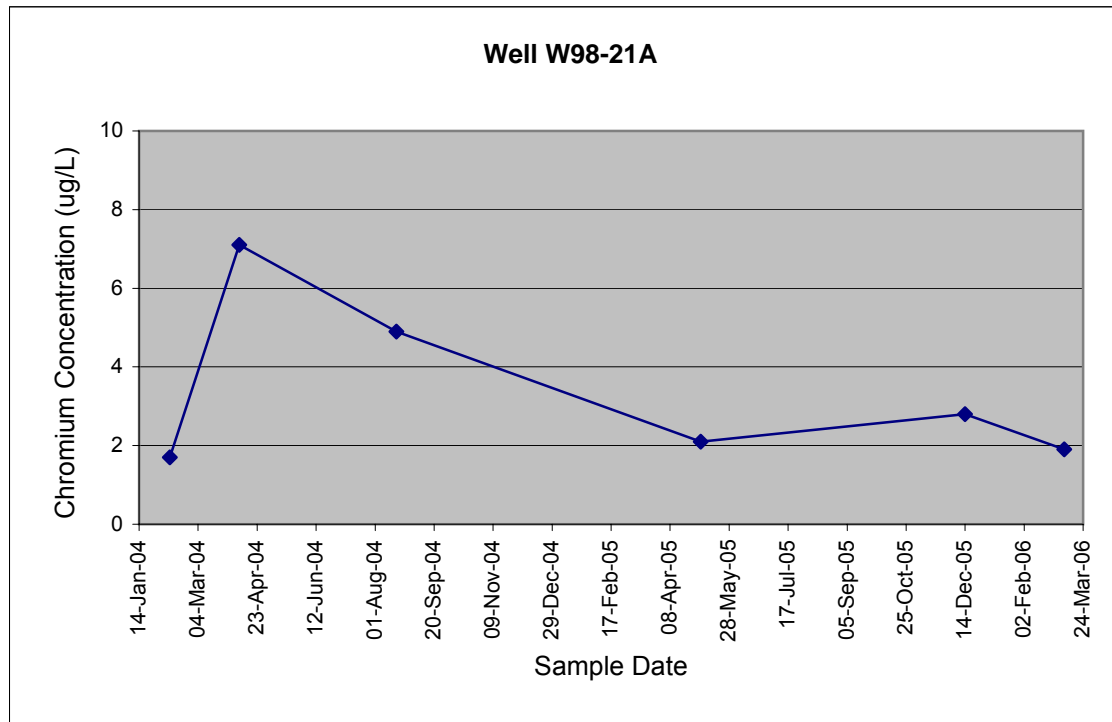
### Well W99-R5B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ5	Water	07-Feb-04	CHROMIUM	7.5	UG/L	J	W99-R5B	Total	0
MJ2BL4	Water	9-Apr-04	CHROMIUM	9.9	UG/L	J	W99-R5B	Total	0
MJ4746	Water	19-Aug-04	CHROMIUM	4.8	UG/L	J	W99-R5B	Total	8
184231	Water	3-May-05	CHROMIUM	6.7	UG/L		W99-R5B	Total	2.3
05504306	Water	14-Dec-05	CHROMIUM	4.5	UG/L		W99-R5B	Total	2.1
104231	Water	6-Mar-06	CHROMIUM	1.8	UG/L		W99-R5B	Total	0



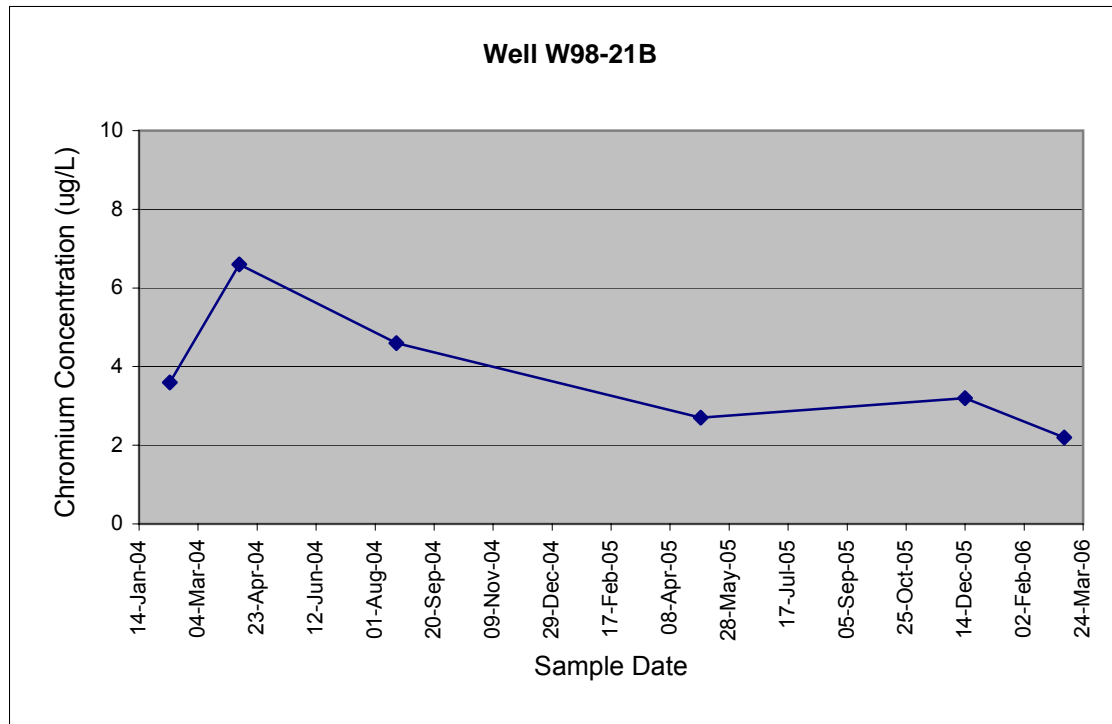
### Well W98-21A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ6	Water	09-Feb-04	CHROMIUM	1.7	UG/L	J	W98-21A	Total	No Data
MJ2BK8	Water	8-Apr-04	CHROMIUM	7.1	UG/L	J	W98-21A	Total	0
MJ4743	Water	19-Aug-04	CHROMIUM	4.9	UG/L	J	W98-21A	Total	0
184237	Water	4-May-05	CHROMIUM	2.1	UG/L		W98-21A	Total	1.3
05504309	Water	14-Dec-05	CHROMIUM	2.8	UG/L		W98-21A	Total	0.1
104261	Water	8-Mar-06	CHROMIUM	1.9	UG/L		W98-21A	Total	0



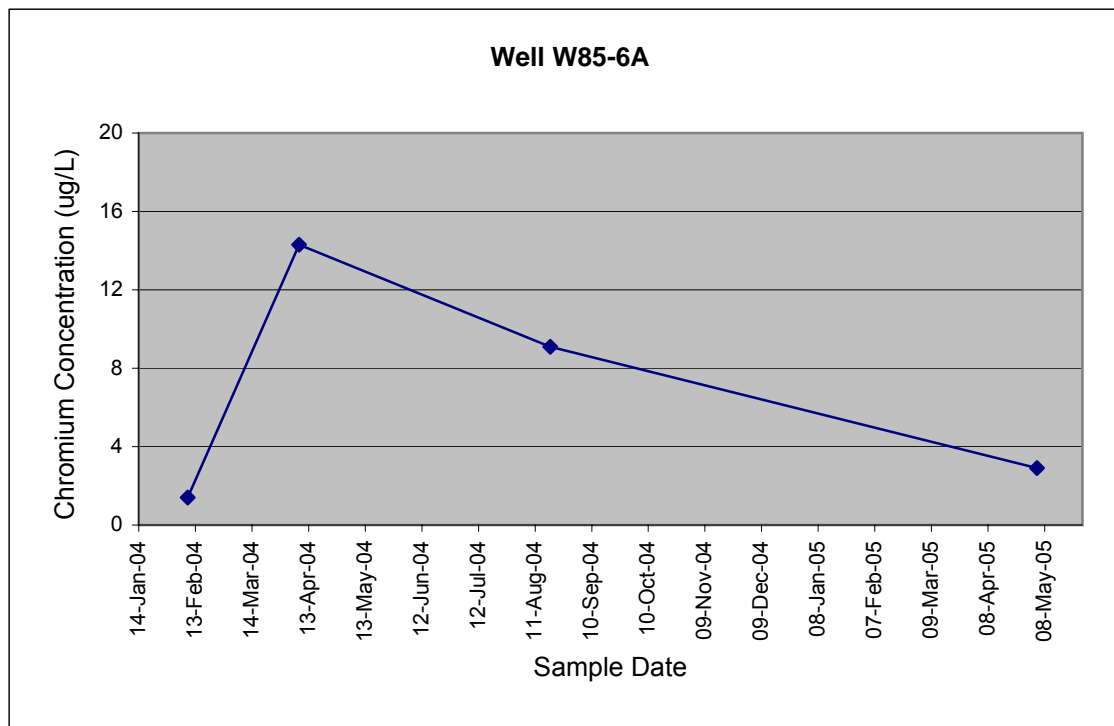
### Well W98-21B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ7	Water	09-Feb-04	CHROMIUM	3.6	UG/L	J	W98-21B	Total	No Data
MJ2BK9	Water	8-Apr-04	CHROMIUM	6.6	UG/L	J	W98-21B	Total	0
MJ4744	Water	19-Aug-04	CHROMIUM	4.6	UG/L	J	W98-21B	Total	5
184238	Water	4-May-05	CHROMIUM	2.7	UG/L		W98-21B	Total	0.5
05504310	Water	14-Dec-05	CHROMIUM	3.2	UG/L		W98-21B	Total	0
104262	Water	8-Mar-06	CHROMIUM	2.2	UG/L		W98-21B	Total	0



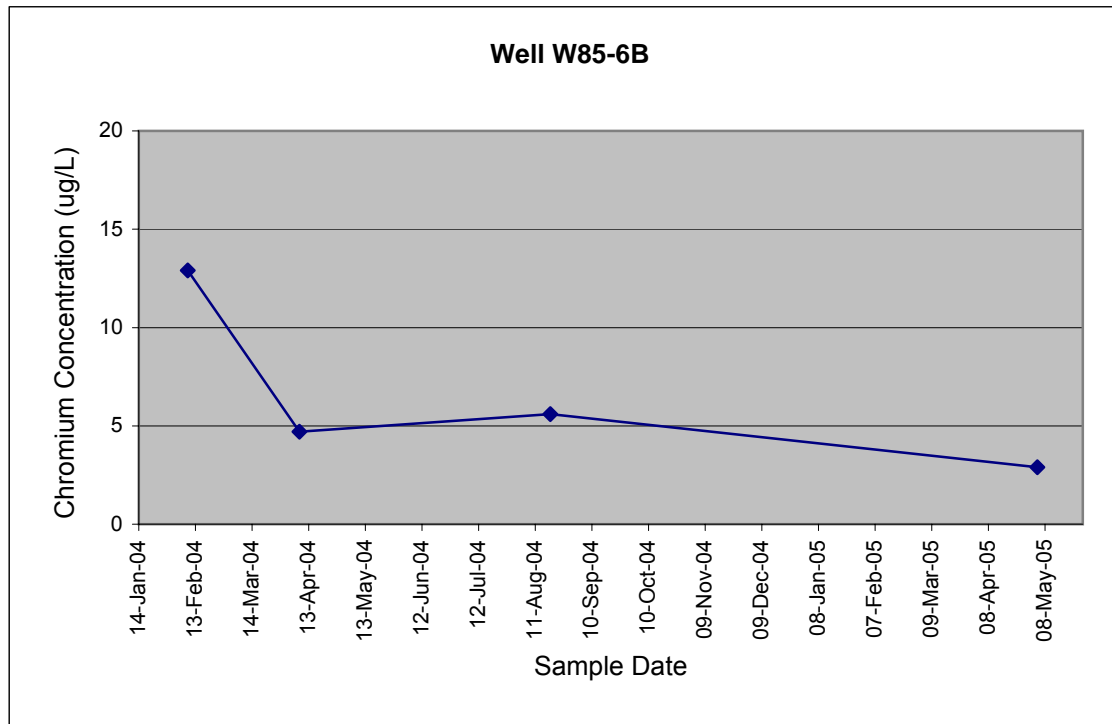
### Well W85-6A

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ8	Water	09-Feb-04	CHROMIUM	1.4	UG/L	J	W85-6A	Total	No Data
MJ2BL0	Water	8-Apr-04	CHROMIUM	14.3	UG/L		W85-6A	Total	0
MJ4747	Water	19-Aug-04	CHROMIUM	9.1	UG/L	J	W85-6A	Total	<10
184235	Water	4-May-05	CHROMIUM	2.9	UG/L		W85-6A	Total	1



### Well W85-6B

Sample No.	Matrix	Sample Date	Analyte	Conc.	Units	Qualifier	Station Location	Notes	NTU
MJ2AJ9	Water	09-Feb-04	CHROMIUM	12.9	UG/L		W85-6B	Total	No Data
MJ2BL1	Water	8-Apr-04	CHROMIUM	4.7	UG/L	J	W85-6B	Total	0
MJ4748	Water	19-Aug-04	CHROMIUM	5.6	UG/L	J	W85-6B	Total	5
184236	Water	4-May-05	CHROMIUM	2.9	UG/L		W85-6B	Total	1



**APPENDIX B**

**LABORATORY DATA SHEETS**

**Washington State Department of Ecology**  
**Manchester Environmental Laboratory**  
**Analysis Report for**  
**Chromium, Dissolved**

Project Name: Frontier Hard Chrome Long Term Monitor					LIMS Project ID: 1175-06			
Project Officer: Guy Barrett			Method: EPA200.8					
Date Reported: 03/15/06			Analyte: Chromium					
Sample	QC	Field ID	Matrix	Result	Qualifier	Units	Collected	Analyzed
06104238		10-4238	Field Filtered water	7.0		ug/L	03/07/06	03/14/06
06104238	LMX1 (matrix spike)			105		%	03/07/06	03/14/06
06104238	LMX2 (matrix spike)			105		%	03/07/06	03/14/06
06104239		10-4239	Field Filtered water	3.4		ug/L	03/07/06	03/14/06
06104241		10-4241	Field Filtered water	3.3		ug/L	03/07/06	03/14/06
06104243		10-4243	Field Filtered water	9.6		ug/L	03/07/06	03/14/06
06104244		10-4244	Field Filtered water	9.1		ug/L	03/07/06	03/14/06
06104252		10-4252	Field Filtered water	8.7		ug/L	03/08/06	03/14/06
MB06073I1	Lab BLNK		Water	1.0	U	ug/L		03/14/06
ML06073I1	Lab LCS-		Water	100		%		03/14/06

Authorized By: M. Jones

Release Date: 3/15/06

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**Washington State Department of Ecology**  
**Manchester Environmental Laboratory**  
**Analysis Report for**  
**Chromium**

**Project Name:** Frontier Hard Chrome Long Term Monitor

**LIMS Project ID:** 1175-06

**Project Officer:** Guy Barrett

**Method:** EPA200.8

**Date Reported:** 03/16/06

**Analyte:** Chromium

Sample	QC	Field ID	Matrix	Result	Qualifier	Units	Collected	Analyzed
06104230		10-4230	Water	0.66		ug/L	03/06/06	03/15/06
06104230	LMX1 (matrix spike)			102		%	03/06/06	03/15/06
06104230	LMX2 (matrix spike)			103		%	03/06/06	03/15/06
06104231		10-4231	Water	1.8		ug/L	03/06/06	03/15/06
06104232		10-4232	Water	5.24		ug/L	03/06/06	03/15/06
06104233		10-4233	Water	1.0		ug/L	03/06/06	03/15/06
06104234		10-4234	Water	0.50	U	ug/L	03/06/06	03/15/06
06104235		10-4235	Water	4.9		ug/L	03/06/06	03/15/06
06104236		10-4236	Water	50.4		ug/L	03/06/06	03/15/06
06104237		10-4237	Water	5.83		ug/L	03/06/06	03/15/06
06104238		10-4238	Water	3.7		ug/L	03/07/06	03/15/06
06104239		10-4239	Water	1.3		ug/L	03/07/06	03/15/06
06104240		10-4240	Water	8.60		ug/L	03/07/06	03/15/06
06104241		10-4241	Water	3.6		ug/L	03/07/06	03/15/06
06104242		10-4242	Water	3.3		ug/L	03/07/06	03/15/06
06104243		10-4243	Water	84.5		ug/L	03/07/06	03/15/06
06104245		10-4245	Water	2.2		ug/L	03/07/06	03/15/06
MB06072I1	Lab BLNK		Water	0.50	U	ug/L		03/15/06
ML06072I1	Lab LCS-		Water	100		%		03/15/06

Authorized By: M. Jansen

Release Date: 3/16/06

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**Washington State Department of Ecology**  
**Manchester Environmental Laboratory**  
**Analysis Report for**  
**Chromium**

Project Name: Frontier Hard Chrome Long Term Monitor						LIMS Project ID: 1175-06		
Project Officer: Guy Barrett				Method: EPA200.8				
Date Reported: 03/23/06				Analyte: Chromium				
Sample	QC	Field ID	Matrix	Result	Qualifier	Units	Collected	Analyzed
06104246		10-4246	Water	1.9		ug/L	03/07/06	03/22/06
06104247		10-4247	Water	0.50	U	ug/L	03/07/06	03/22/06
06104248		10-4248	Water	1.4		ug/L	03/07/06	03/22/06
06104249		10-4249	Water	0.50	U	ug/L	03/07/06	03/22/06
06104250		10-4250	Water	1.8		ug/L	03/07/06	03/22/06
06104251		10-4251	Water	5.32		ug/L	03/07/06	03/22/06
06104252		10-4252	Water	192		ug/L	03/08/06	03/22/06
06104253		10-4253	Water	152		ug/L	03/08/06	03/22/06
06104254		10-4254	Water	1.7		ug/L	03/08/06	03/22/06
06104255		10-4255	Water	0.50	U	ug/L	03/08/06	03/22/06
06104256		10-4256	Water	0.53		ug/L	03/08/06	03/22/06
06104257		10-4257	Water	0.50	U	ug/L	03/08/06	03/22/06
06104258		10-4258	Water	1.5		ug/L	03/08/06	03/22/06
06104259		10-4259	Water	1.2		ug/L	03/08/06	03/22/06
06104260		10-4260	Water	1.8		ug/L	03/08/06	03/22/06
06104261		10-4261	Water	1.9		ug/L	03/08/06	03/22/06
06104262		10-4262	Water	2.2		ug/L	03/08/06	03/22/06
06104262	LMX1 (matrix spike)			109		%	03/08/06	03/22/06
06104262	LMX2 (matrix spike)			111		%	03/08/06	03/22/06
MB06076I1	Lab BLNK		Water	0.50	U	ug/L		03/22/06
ML06076I1	Lab LCS-		Water	105		%		03/22/06

Authorized By: M. Jones

Release Date: 3/23/06

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**APPENDIX C**  
**DATA VALIDATION MEMORANDUM**

## EXCEPTION SUMMARY FOR LABORATORY DATA QUALITY ASSURANCE REVIEW

### DATA SUMMARY

The laboratory data quality assurance review and validation of analytical results for 33 water samples, Project Number 1175-06, collected between 06 March 2006 and 08 March 2006 from the Frontier Hard Chrome site has been completed. This review incorporates sample results for other metals for assessment purposes, but applies only to the following analyses:

- Total and dissolved chromium by Washing State Department of Ecology's (WDOE) Manchester Environmental Laboratory (MEL), of Port Orchard, Washington, following EPA Method 200.8 – inductively-coupled plasma/mass spectrometry (IC/MS).

Quality assurance/quality control (QA/QC) reviews of laboratory procedures were performed on an ongoing basis by the laboratory. A data review was performed by the laboratory QA section on laboratory quality control results to ensure they met data quality objectives for the project. Data review followed the format outlined in the *National Functional Guidelines for Inorganic Data Review* (EPA 2004), modified to include specific criteria specified in the *Frontier Hard Chrome Long-Term Monitoring Plan* (Work Plan; Weston 2004). Raw laboratory data including calibrations, sample login forms, sample preparation logs and bench sheets, quantitation reports, mass spectra, and chromatograms were not available for this review.

This is an exception summary. All laboratory quality assurance results as applicable (e.g., holding times, blank sample analysis, matrix spike/duplicate analysis, laboratory control sample analysis) supplied to Weston for the analyses met acceptance criteria specified in the Work Plan (Weston 2004), with the following exceptions:

### COMPARISON OF TOTAL VERSUS DISSOLVED CHROMIUM CONCENTRATIONS

Samples **RA-MW-12A** and **RA-MW-15B** were collected both as total (unfiltered) and dissolved (field-filtered) fractions – with one fraction submitted for total recoverable chromium analysis and the other filtered at the time of collection and submitted for dissolved chromium analysis.

Determination of duplicate precision, reported as relative percent difference (RPD), yielded acceptable results. As expected – and likely due to the presence of suspended, black particulate matter assumed to be metal sulfides – the RPD for the unfiltered sample aliquots (23.2%) slightly exceeded the commonly-accepted value of 20-percent for aqueous samples. The following table summarizes detected concentrations and RPD values for the filtered and unfiltered field duplicate samples.

**FHC LTM Field Duplicate Precision  
March 2006 Sampling Event**

<b>RA Monitoring Well</b>	<b>Field ID</b>	<b>Total Cr (u/L)</b>	<b>Dissolved Cr (ug/L)</b>	<b>RPD (percent)</b>
12A	10-4243	84.5	9.6	5.3 (filtered)
	10-4244	-	9.1	
15B	10-4252	192	8.7	23.2 (unfiltered)
	10-4253	152	-	

## OTHER DATA QUALIFICATION

No other QA/QC exceptions were noted in the data review. Upon consideration of the data qualifications noted above and the project data quality objectives specified in the QAPP, the data are ACCEPTABLE for use except where flagged with data qualifiers that modify the usefulness of the individual values

## DATA QUALIFIERS

**Any data qualifiers applied by the laboratory have been removed from the data summary sheets and superceded by data validation qualifiers as follow:**

The following qualifiers were used to modify the data quality and usefulness of individual analytical results.

- U** - The analyte was not detected at the given quantitation limit.
- UJ** - The analyte was positively identified and detected; however, the quantitation limit is an estimated value because quality control criteria were not met.
- J** - The analyte was positively identified and detected; however, the concentration is an estimated value because the result is less than the quantitation limit or quality control criteria were not met.

## **DATA ASSESSMENT**

Data review was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project.

This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment the data are acceptable for use except where qualified with qualifiers that modify the usefulness of those individual values.

Original signed

R. Paul Swift, Ph.D.  
Chief Chemist

4-28-06

Date